



## CONSUMER PRODUCT SAFETY COMMISSION

### 16 CFR Part 1408

[CPSC Docket No. CPSC–2019-0020]

#### Safety Standard for Residential Gas Furnaces and Boilers

**AGENCY:** Consumer Product Safety Commission.

**ACTION:** Notice of proposed rulemaking; notice of opportunity for oral presentation of comments.

**SUMMARY:** The U.S. Consumer Product Safety Commission (Commission or CPSC) has determined preliminarily that there is an unreasonable risk of injury and death associated with residential gas fired central furnaces, boilers, wall furnaces, and floor furnaces (gas furnaces and boilers). To address this risk, the Commission proposes a rule to detect and prevent dangerous levels of carbon monoxide (CO) production and leakage from residential gas furnaces and boilers. The Commission is providing an opportunity for interested parties to present written and oral comments on this notice of proposed rulemaking (NPR).

**DATES:** *Deadline for Written Comments:* Written comments must be received by [INSERT DATE THAT IS 60 DAYS AFTER PUBLICATION IN THE FEDERAL REGISTER].

*Deadline for Request to Present Oral Comments:* Any person interested in making an oral presentation must send an e-mail indicating this intent to the Office of the Secretary at [cpsc-os@cpsc.gov](mailto:cpsc-os@cpsc.gov) by [INSERT DATE THAT IS 60 DAYS AFTER PUBLICATION IN THE FEDERAL REGISTER].

**ADDRESSES:** *Written Comments:* Comments related to the Paperwork Reduction Act aspects of the proposed rule should be directed to the Office of Information and Regulatory Affairs, OMB, Attn: CPSC Desk Officer, FAX: 202-395-6974, or e-mailed to [oir\\_submission@omb.eop.gov](mailto:oir_submission@omb.eop.gov).

Other written comments in response to the proposed rule, identified by Docket No. CPSC-2019-0020, may be submitted by any of the following methods:

*Electronic Submissions:* Submit electronic comments to the Federal eRulemaking Portal at: [www.regulations.gov](http://www.regulations.gov). Follow the instructions for submitting comments. CPSC typically does not accept comments submitted by e-mail, except as described below. CPSC encourages you to submit electronic comments by using the Federal eRulemaking Portal, as described above.

*Mail/hand delivery/courier Written Submissions:* Submit comments by mail/hand delivery/courier to: Office of the Secretary, Consumer Product Safety Commission, 4330 East West Highway, Bethesda, MD 20814; telephone: (301) 504-7479. If you wish to submit confidential business information, trade secret information, or other sensitive or protected information that you do not want to be available to the public, you may submit such comments by mail, hand delivery, courier, or you may e-mail them to: [cpsc-os@cpsc.gov](mailto:cpsc-os@cpsc.gov).

*Instructions:* All submissions must include the agency name and docket number. CPSC may post all comments without change, including any personal identifiers, contact information, or other personal information provided to: [www.regulations.gov](http://www.regulations.gov). Do not submit through this website: confidential business information, trade secret information, or other sensitive or protected information that you do not want to be available to the public. If you wish to submit such information, please submit it according to the instructions for mail/hand delivery/courier written submissions.

*Docket for NPR:* For access to the docket to read background documents or comments received, go to: [www.regulations.gov](http://www.regulations.gov), insert the docket number CPSC-2019-0020 into the “Search” box, and follow the prompts.

**FOR FURTHER INFORMATION CONTACT:** Ronald A. Jordan, Directorate for Engineering Sciences, Mechanical Engineering, Consumer Product Safety Commission, National

Product Testing and Evaluation Center, 5 Research Place, Rockville, MD 20850; telephone: 301-987-2219; [rjordan@cpsc.gov](mailto:rjordan@cpsc.gov).

## **SUPPLEMENTARY INFORMATION:**

### **I. Background**

On August 19, 2019, the Commission published an advance notice of proposed rulemaking (ANPR) to develop a rule to address the risk of injury associated with residential gas furnaces and boilers from CO production and leakage. 84 FR 42847. The Commission received 15 comments. The Commission is now proceeding with this proposed rulemaking.<sup>1</sup> The information discussed in this preamble is derived from CPSC the Staff Briefing Package for the NPR, which is available on CPSC's website at: <https://www.cpsc.gov/s3fs-public/Notice-of-Proposed-Rulemaking-Safety-Standard-for-Residential-Gas-Furnaces-and-Boilers-COMBINED-PDFS.pdf?VersionId=7BJ3c6EeDF78nHorx2mCEr94XygwgeQV>.

### **II. Statutory Authority**

This rulemaking falls under the authority of the CPSA, (Consumer Product Safety Act) 15 U.S.C. 2051-2089. Section 7(a) of the CPSA authorizes the Commission to promulgate a mandatory consumer product safety standard that sets forth performance or labeling requirements for a consumer product, if such requirements are reasonably necessary to prevent or reduce an unreasonable risk of injury. 15 U.S.C. 2056(a). Section 9 of the CPSA specifies the procedure that the Commission must follow to issue a consumer product safety standard under section 7 of the CPSA. In accordance with section 9, the Commission commenced this rulemaking by issuing an ANPR.

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<sup>1</sup> The Commission voted (4-0) to publish this notice of proposed rulemaking as drafted. Commissioner Feldman issued a statement in connection with his vote, available at: [https://www.cpsc.gov/s3fs-public/Comm-Mtg-Min-Infant-Rockers-NPR-and-Gas-Furnaces-and-Boilers-NPR.pdf?VersionId=8Ct.NBI7RhSXyozTJBE65q3lCSyU\\_aMl](https://www.cpsc.gov/s3fs-public/Comm-Mtg-Min-Infant-Rockers-NPR-and-Gas-Furnaces-and-Boilers-NPR.pdf?VersionId=8Ct.NBI7RhSXyozTJBE65q3lCSyU_aMl).

According to section 9(f)(1) of the CPSA, before promulgating a consumer product safety rule, the Commission must consider, and make appropriate findings to be included in the rule, on the following issues:

- (A) The degree and nature of the risk of injury that the rule is designed to eliminate or reduce;
- (B) the approximate number of consumer products, or types or classes of product, subject to the rule;
- (C) the need of the public for the products subject to the rule and the probable effect the rule will have on utility, cost, or availability of such products; and
- (D) the means to achieve the objective of the rule while minimizing adverse effects on competition, manufacturing, and commercial practices consistent with public health and safety.

15 U.S.C. 2058(f)(1).

Under section 9(f)(3) of the CPSA, to issue a final rule, the Commission must find that the rule is “reasonably necessary to eliminate or reduce an unreasonable risk of injury associated with such product” and that issuing the rule is in the public interest. 15 U.S.C. 2058(f)(3)(A) and (B). Additionally, if a voluntary standard addressing the risk of injury has been adopted and implemented, the Commission must find that:

- The voluntary standard is not likely to eliminate or adequately reduce the risk of injury, or
- substantial compliance with the voluntary standard is unlikely.

15 U.S.C. 2058(f)(3)(D). The Commission also must find that expected benefits of the rule bear a reasonable relationship to its costs and that the rule imposes the least burdensome requirements that would adequately reduce the risk of injury. 15 U.S.C. 2058(f)(3)(E) and (F).

### **III. The Product**

Central furnaces, boilers, wall furnaces, and floor furnaces fueled by natural gas or propane (gas furnaces and boilers) are used to heat all categories of consumer dwellings.

These products burn a mixture of gas and air within the combustion chamber of a heat exchanger. As the mixture of fuel and air is burned, heat is released and transferred through the wall of the heat exchanger to the medium surrounding the heat exchanger and circulated through air ducts (for central furnaces), water pipes throughout the dwelling (for boilers), or directly into the ambient air to provide heat (for wall furnaces and floor furnaces).

Burning the mixture of fuel and air results in the formation of combustion products that are typically composed of oxygen, carbon dioxide, water vapor, and CO. The combustion products are exhausted to the outdoors through a vent system, either vertically through the roof or horizontally through a side wall through the vent pipe. When the mixture of fuel and air is burned completely, the concentration of CO produced should remain relatively low. However, when issues arise with the combustion process (such as fuel-air mixtures that are not optimal), dangerous levels of CO can be produced. The combination of production of dangerous levels of CO during the combustion process and leakage of that CO through the vent system into the living space is a potentially deadly hazard pattern identified by CPSC staff.

In a gas-fired central furnace (Figure 1), air is the medium that surrounds and is heated by the heat exchanger. A large fan is used to force-circulate the heated air across the exterior surfaces of the heat exchanger, through a duct system, and then the heated air exits the duct system through warm air registers typically within the dwelling. The arrow in Figure 1 depicts the vent pipe.

In a gas boiler (Figure 2), water or steam is the medium that surrounds and is heated by the heat exchanger. The heated water or steam is circulated, using a pump to force the fluid through a piping system to radiators typically in each room in the dwelling. Living areas are heated through radiative and conductive heat transfer from the heated water or steam supplied to the radiators to the room. Gas-fired central furnaces and boilers are considered central heating appliances because they provide heat to each room of a dwelling. The arrow in Figure

2 points to the boiler's vent pipe.

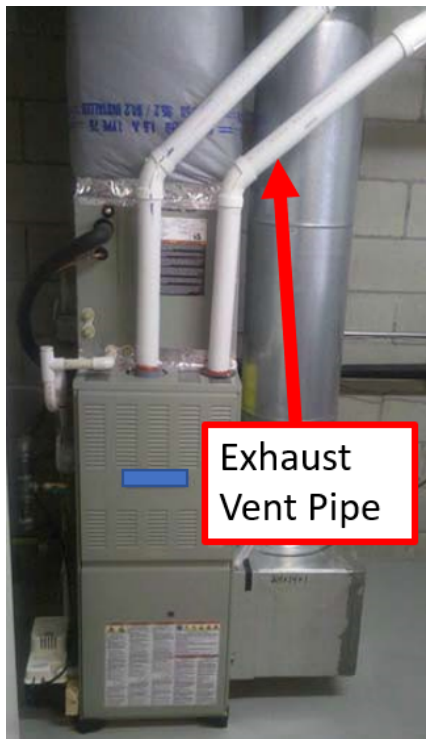


Figure 1. Gas-fired central furnace

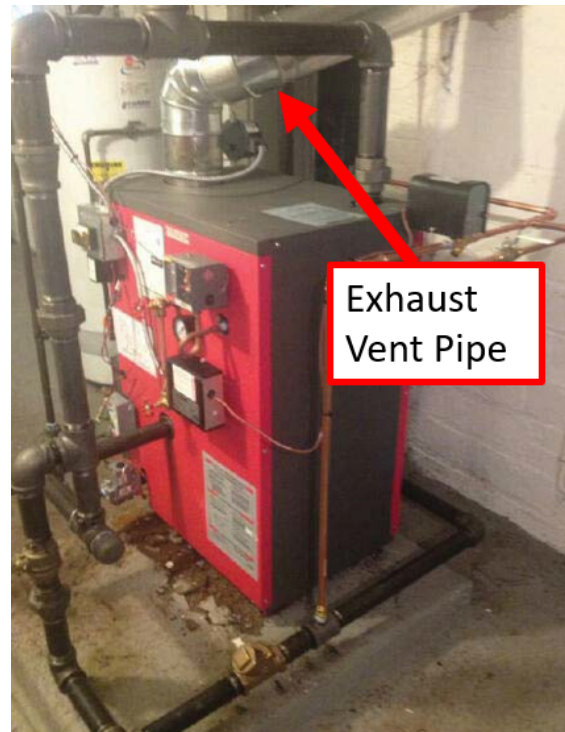


Figure 2. Gas boiler

In addition to central gas-fired furnaces and boilers, the proposed scope of the NPR also includes gas wall furnaces (Figure 3) and gas floor furnaces (Figure 4). As their names indicate, gas wall furnaces are installed in wall spaces, typically between the wall stud framing members; and floor furnaces are installed in the floor, typically between the floor joist framing members. Wall furnaces and floor furnaces provide localized heating directly to the room in which they are located, and indirectly to adjoining rooms within the dwelling. The combustion products of wall furnaces are vented to the outdoors, either vertically through the roof, or horizontally through a side wall with the vent pipe running along the length of the wall studs between which the unit is installed. The combustion products of a floor furnace are typically vented horizontally through a side wall, with the vent pipe running along the length of the floor joists between which the unit is installed and through an exterior wall.



Figure 3. Gas wall furnace



Figure 4. Gas floor furnace

## IV. Risk of Injury

### *A. Incident Data*

#### 1. Fatalities

From the time period of 2017 to 2019 (the most recent period for which data are complete), there were annually an estimated 21 CO-related deaths associated with gas furnaces and boilers (burning liquefied petroleum, natural gas, and unspecified gas).<sup>2</sup> For the 20-year period, 2000 through 2019, these products were associated with a total of 539 deaths from CO poisoning. Tab A of the Staff NPR Briefing Package provides further information regarding fatalities.

#### 2. Injury Estimates

To estimate the number of injuries associated with CO exposure from natural gas and propane furnaces and boilers, an interdisciplinary team of CPSC staff evaluated injuries reported through the National Electronic Injury Surveillance System (NEISS) (*See* Tab J of the Staff NPR Briefing Package). Staff queried NEISS for data between the years 2014 and 2018. Staff identified 236 nonfatal injuries related to CO leakages from gas furnaces and boilers that occurred during this period. Of the 236 nonfatal injuries, 18 resulted in hospital

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<sup>2</sup> *Non-Fire Carbon Monoxide Deaths Associated with the Use of Consumer Products 2019 Annual Estimates*. J. Topping, CPSC Directorate for Epidemiology. March 2023. <https://www.cpsc.gov/s3fs-public/NonFireCarbonMonoxideDeathsAssociatedwiththeUseofConsumerProducts2019AnnualEstimates.pdf?VersionId=90WCZoH61aVUrTgDtOo16LLKZf1EeH3E>.

admissions via the emergency department (ED), and 218 were treated in the ED and released. Staff used NEISS incidents and the Injury Cost Model (ICM) to extrapolate and generate national estimates for injuries from CO leakages from gas furnaces and boilers treated in EDs and other settings. Staff, using the ICM, calculated that the aggregate number of nonfatal injuries from CO leakages from gas furnaces and boilers from 2014 to 2018 was 30,587. Staff estimated that of the 30,587 injuries, 22,817 were treated in an outpatient setting (*e.g.*, doctor's office, or clinic), 7,358 resulted in ED treatment, 333 resulted in hospital admissions via the ED, and 79 resulted in direct hospital admissions.

### *B. Description of Hazard - Acute CO Poisoning*

In Tab C of the Staff ANPR Briefing Package<sup>3</sup> staff described the hazard pattern for CO poisoning associated with gas furnaces and boilers; which involves (1) hazardous levels of CO from incomplete combustion of the source fuel/gas and (2) exhaust leakage of that hazardous CO into the living space through a leak in the exhaust vent system. Staff's review of the 83 incidents, in conjunction with findings from earlier in-depth investigation (IDI) reviews, identified the following factors related to the incomplete combustion and exhaust leakage hazard patterns.

#### 1. Production of Dangerous Levels of CO from Incomplete Combustion

Complete combustion of hydrocarbon fuels, such as natural gas or liquefied petroleum gas (LP-gas or propane), requires a proper mixture of air and fuel, as well as an adequate amount of heat to ignite the combustion air-fuel mixture. Incomplete combustion of the fuel supplied to gas appliances can lead to production of hazardous levels of CO. Incomplete combustion can occur when there is inadequate combustion of air (for instance when air openings to the appliance combustion chamber or burner assembly, or the exhaust outlet from

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<sup>3</sup> Draft Advance Notice of Proposed Rulemaking: Performance Requirements for Residential Gas Furnaces and Boilers. Retrieved at: <https://cpsc.gov/s3fs-public/Draft%20ANPR%20-%20Performance%20Requirements%20for%20Residential%20Gas%20Furnaces%20and%20Boilers.pdf>



the appliance is blocked); too much fuel is supplied to the appliance burner (*i.e.*, over-firing); or the burner flame temperature falls below the ignition temperature of the combustion air-fuel mixture (*i.e.*, flame quenching). Depending on the severity and duration, all these conditions can result in incomplete combustion of the fuel; which, in turn, can result in the gas furnace or boiler producing dangerous levels of CO. Staff's ongoing review of IDIs confirms that these hazard patterns have not changed since the publication of the ANPR.

## 2. Exhaust leakage

Combustion products produced by a gas furnace or boiler are normally vented to remove them from the home through a properly functioning vent system. A potential CO hazard in a home can arise if the combustion system of a gas furnace or boiler malfunctions and produces hazardous levels of CO, which a compromised exhaust system then allows to leak into the occupied space of the home. Typical exhaust failure leakage paths include a totally or partially blocked vent, chimney, heat exchanger, or a disconnected or hole in the vent pipe.

Another potential leakage mechanism occurs when an exhaust fan or fireplace is installed near a gas furnace or boiler. The operation of an exhaust fan or a warm chimney created by a fireplace can pull air out of the room in which the gas furnace or boiler is installed. This can depressurize the room, resulting in reverse flow of the combustion products through the gas furnace or boiler vent system or flue passageways. Instead of being vented safely to the outdoors, depressurization can cause CO to spill into the living space. Other mechanisms that can lead to spillage include venting that is inadequate for the gas furnace or boiler connected to it. This can be caused by total or partial vent blockage, installation of a vent pipe that is too small for the gas furnace or boiler, or the connection of too many appliances to the vent.

## **V. Assessment of Relevant Existing Voluntary Standards**

### *A. U.S. Voluntary Standards*

#### 1. Description of Existing U.S. Voluntary Standards for Gas Furnaces and Boilers

In the United States, the four types of gas furnaces and boilers within the scope of the proposed rule are covered by the following ANSI Z21 voluntary standards:

- ANSI Z21.13-2022, *Standard for Gas-fired low pressure steam and hot water boilers*: This standard specifies construction and performance requirements for gas-fired, low-pressure steam and hot water boilers with input ratings of less than 12,500,000 Btu/hr (3,663 kW). The first edition of the standard was published in 1934, and the standard has been revised several times, with the latest edition published in 2022.
- ANSI Z21.47-2021, *Standard for Gas-fired central furnaces*: This standard specifies construction and performance requirements for gas-fired central furnaces with input ratings up to and including 400,000 Btu/hr (117 kW) for installation in residential, commercial, and industrial structures including furnaces for direct vent, recreational vehicle, outdoor, and manufactured (mobile) homes. The requirements for gas-fired central furnaces were initially included in ANSI Z21.13, before becoming a separate standard in 1964. From 1978 through 1993, a separate standard for direct vent central furnaces (ANSI Z21.64) was in place before being consolidated into a single standard and harmonized with Canadian standard requirements in 1993, with the latest edition of ANSI Z21.47 published in 2021.
- ANSI Z21.86-2016, *Standard for Vented gas-fired space heating appliances*: This standard specifies construction and performance requirements for vented gas-fired space heating appliances with input ratings up to and including 400,000 Btu/hr (117 kW), including gravity and fan type direct-vent wall furnaces and gravity and fan-type floor furnaces. The ANSI Z21.86 standard was first published in 1998, with the latest edition published in 2016.

All three ANSI standards have the following relevant requirements for gas furnaces and boilers:

- must not produce CO in excess of 400 ppm (under prescribed laboratory test conditions);
- shut off when vent or flue is fully blocked;

- shut off when blower door is not sealed properly (gas-fired central furnaces only); and
- shut off if flames issue outside of the burner compartment.

## 2. CPSC Voluntary Standards Activity

In 2000, CPSC staff proposed voluntary standard provisions that would require a gas furnace (ANSI Z21/83 Technical Committee subsequently extended the consideration of the proposed standards provisions to all vented heating appliances including boilers):

- to shut down if the vent pipe became disconnected; and
- to shut down if the vent pipe became totally or partially blocked; or
- to have a means to prevent CO emissions from exceeding the standard limits once installed in the field; and
- to have a means, once installed in the field, to shut down if CO emissions exceeded the standard limits.

In 2002, the ANSI Z21/83 Technical Committee (TC) established a working group to evaluate the feasibility of using CO and combustion sensor technology to implement CPSC staff's CO shutoff/response proposal. CPSC staff participated in that working group from 2002 through 2005. ANSI disbanded this working group in 2005 because manufacturers expressed concerns that there were no sensors commercially available that had the durability or longevity to operate within a gas furnace or boiler for their expected 20-year lifespan. CPSC staff conducted additional sensor testing from 2007 to 2008 to evaluate and assess the ANSI Z21/83 TC's and working group's concerns.

In 2014, the Commission published a request for information (79 FR 21442) and hosted a Carbon Monoxide/Combustion Sensor Forum to gather more information on the availability and feasibility of CO and combustion sensors for use in gas furnaces and boilers.

In 2015, the Z21/83 TC established another working group to evaluate a new CPSC staff proposal to add performance requirements for CO Shutoff/Responses to the voluntary standards for gas-fired central furnaces and, boilers, wall furnaces, and floor furnaces. The

Z21/83 Technical Committee assessed that the technology required to meet the performance requirements was not feasible. The working group disbanded in 2019 without proposing any revisions to the voluntary standard that would adequately mitigate the CO hazard associated with gas furnaces and boilers.

In Tab D of the 2019 Staff ANPR Briefing Package, staff analyzed the three ANSI voluntary standards and concluded that none of the existing voluntary standards included requirements to protect against many of the known failure modes or conditions that have been associated with production and leakage of CO into living spaces. Since publication of the ANPR in August 2019, none of the existing ANSI voluntary standards discussed above have been revised to address the known failure modes or conditions associated with CO poisoning, such as disconnection, breach, or partial blocking of flues, vents, and chimneys.

### *B. International Standards*

Existing Japanese and European gas appliance voluntary standards include CO shutoff or combustion control<sup>4</sup> requirements, with reliance on gas sensing technologies to implement those standards' requirements.

#### 1. Japan

The primary gas heating appliances used in Japan are gas water heaters, gas boilers, and gas space heaters. Based on staff's review of the Japanese gas appliance market, instantaneous tankless gas water heaters<sup>5</sup> (Figure 6) are more common than traditional gas water heaters with storage tanks.

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<sup>4</sup> Combustion control refers to a means to control the combustion of a gas/air mixture to ensure complete combustion of the gas/air mixture and to limit the production of carbon monoxide.

<sup>5</sup> Instantaneous tankless gas water heaters provide heated water on demand and therefore, do not require the use of a large storage tank, whereas traditional gas storage water heaters include a large storage tank used to store heated water.



Figure 6. Japanese tankless gas water heater

The governing voluntary performance and safety standards in Japan are:

- JIS-S-2109 - Gas-burning water heaters for domestic use;
- JIS S 2112 - Gas hydronic<sup>6</sup> heating appliances for domestic use; and
- JIS S 2122 - Gas-burning space heaters for domestic use.

These Japanese Industrial Standards (JIS) have explicit performance requirements for vented gas water heaters, gas boilers, and gas space heaters that require shutoff of the appliance in response to CO levels above a certain threshold (*i.e.*, 300 ppm CO). The CO detection strategies Japanese manufacturers use to comply with JIS include detection of CO within the combustion chamber of the appliance and shutoff or combustion control in response to detection of hazardous levels of CO.

## 2. Europe

The relevant Committee for European Standardization (CEN) standards for residential gas boilers (depicted in Figure 7 below) are:

- EN 15502 -1, Gas-fired heating boilers, Part 1: General requirements and tests;
- EN 15502-2-1, Gas-fired central heating boilers, Part 2-1: Specific standard for type C

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<sup>6</sup> “Hydronic” denotes a cooling or heating system in which heat is transported using circulating water. A boiler is a type of appliance that provides this capability.

appliances and type B2, B3 and B5 appliances of a nominal heat input not exceeding 1 000 kW; and

- EN 15502-2-2, Gas-fired central heating boilers, Part 2-2: Specific standard for type B1 appliances.



Figure 7. European gas boiler

These CEN standards include explicit performance requirements for gas boilers to either shut down before the CO concentration inside the flue exceeds 2,000 ppm or not start if the CO concentration exceeds 1,000 ppm.

### *C. Staff Assessment of Voluntary Standards*

Based on staff's analysis of the relevant ANSI standards, staff concludes that the current ANSI Z21.13-2022, ANSI Z21.47-2021, and ANSI Z21.86-2016 standards do not contain performance requirements to protect against the known failure modes or conditions identified by the Commission. Specifically, the current ANSI standards lack requirements (1) that protect against known conditions that cause or contribute to CO exposure and (2) for the appliance to monitor and manage CO production to prevent the introduction of hazardous levels of CO in the appliance's exhaust vent system. Currently, deaths and injuries can and do occur from CO poisoning even when the furnace or boiler complies with all applicable existing voluntary standards in the U.S. Based on the above discussion and the analysis in the Staff NPR Briefing

Package, the Commission concludes that the existing ANSI standards for gas furnaces and boilers are inadequate to address the hazards identified by CPSC.

In addition, staff has researched international standards that required the same or similar performance requirements as staff's 2000 and 2015 proposals to the Z21/83 Technical Committee. Staff identified several gas-sensing technologies that were being used for CO shutoff or combustion control of residential gas appliances used in Japan and Europe to correspond with the respective standards. The CO-detection strategies used by Japanese manufacturers include detection of CO within the combustion chamber of the appliance and shutoff or combustion control in response.

In Europe, residential gas boilers are required to meet certain European combustion-efficiency requirements, as well as CO safety requirements. The combustion-control strategies used by European gas boiler manufacturers to comply with the standards are often accomplished by monitoring the gas/air mixture, the combustion flame, or the concentration of CO, oxygen, or carbon dioxide within the combustion products. The combustion-control strategies are also used to detect CO, but rather than causing shut-down of the appliance, CO production is either prevented or limited by modulating the appliance's operation. The Japanese and European standards do not specify a minimum lifespan for sensing devices used to implement their respective CO safety and combustion efficiency requirements. However, adoption of the European and Japanese standards for U.S. gas furnaces and boilers would not be appropriate because of the design differences between European and Japanese products and U.S. gas furnaces and boilers, as well as the different regulations and standards requirements (other than CO safety related requirements) that European and Japanese appliances are required to comply with that would not apply to appliances made and sold in the U.S.

## **VI. Technical Justification for the Proposed Performance Requirements**

### *A. Testing and Evaluation Conducted by Contractors*

Tab C of the Staff NPR Briefing Package includes links to the contractor reports

regarding the research and testing conducted to assist in developing staff's proposed mandatory performance requirements. In 2019, a CPSC contract was awarded to Guidehouse (formerly Navigant, Inc.) to study the impact of CO/combustion sensors used in residential gas boilers and water heaters in Europe and Japan and to gain a better understanding of the use of CO sensors in gas appliances in other parts of the world and their impact in mitigating CO risks associated with gas appliances. This contract work was also commissioned to assess industry concerns about the feasibility of using sensors in the exhaust flue of gas furnaces and boilers. Work on this contract concluded in 2021 and the findings are documented in a contractor report titled, "Review of Combustion Control and Carbon Monoxide Sensors in Europe and Japan," dated June 28, 2021. The Guidehouse report is included as attachment 3 of Tab C of the staff NPR Briefing Package.

The Guidehouse report found that in Europe, gas appliance safety is governed by European Union (EU) Regulation 2016/426 on appliances burning gaseous fuels, and compliance with the applicable standard published by the CEN is generally considered a means to demonstrate compliance with the regulation. In Japan, the Gas Business Act and the Act on the Securing of Safety and the Optimization of Transaction of Liquefied Petroleum Gas require that a manufacturer or importer ensure that the gas-fired equipment conforms to the technical standards established by an Ordinance of the Ministry of Economy, Trade and Industry (METI). European and Japanese manufacturers limit CO production with combustion safety systems, combustion control systems, direct CO sensing in the exhaust path, or a combination of these approaches. The available data revealed that CO deaths and injuries in the EU and Japan were declining. However, the Guidehouse report noted that additional factors, such as other CO alarm usage and education and market changes, likely played a role in these reductions of CO deaths and injuries as well.

The Guidehouse report also found the designs used in U.S. residential heating and water heating appliances differ significantly from those used in Japan and Europe. In Europe and



Japan, gas boilers are commonly used for space heating and the market has transitioned almost entirely to condensing systems that utilize premix power burners. The Guidehouse report also found that appliances with design platforms based on premix power burners are better suited to incorporate combustion control because they typically have a single burner, a single heat exchanger cell, and a single flame ionization sensor to monitor the burner flame.

CPSC also procured two contracts with ANSYS, Inc. (formerly DfR Solutions, Inc.) to estimate the expected lifespans of CO/combustion sensors while operating in a gas furnace or boiler application. The report titled “Performance and Accelerated Life Testing of Carbon Monoxide and Combustion Sensors,” dated May 28, 2019, is included as attachment 1 of Tab C of the Staff NPR Briefing Package. The report titled “Performance and Accelerated Life Testing of Redesigned Carbon Monoxide and Combustion Gas Sensors,” dated February 25, 2022, is included as attachment 2 of Tab C of the Staff NPR Briefing Package. The ANSYS report demonstrated that CO/combustion sensors are currently commercially available for use in gas appliances; the CO/combustion sensors that were tested had expected lifespans ranging from 6.4 to 10 years operating under conditions that replicate the main stress conditions expected within a gas appliance.

#### *B. Justification for Proposed Performance Requirements*

The proposed performance requirements are reasonably necessary and feasible for the following reasons:

- The gas furnaces and boilers under consideration are associated with an estimated 21 deaths per year, on average (2017-2019), and an estimated total of 539 CO deaths from 2000 to 2019;
- the existing voluntary standards do not include provisions that would protect consumers from a number of conditions described in section IV of the preamble that are known to cause or contribute to the production, leakage into, and accumulation of dangerous concentrations of CO in the living space of a dwelling;

- there is no indication that the Z21/83 Technical Committee or any of the technical Subcommittees for gas furnaces and boilers intend to address this hazard; and
- continuous monitoring of the combustion process or the concentration of carbon monoxide within the combustion gases can be accomplished using commercially available CO/combustion sensing or combustion control technology.

The proposed performance requirements described in this section of the preamble are intended to reduce the occurrence of CO-related deaths, injuries, and exposures associated with gas furnaces and boilers. Specifically, gas furnaces and boilers would continuously monitor CO emissions and shut down or modulate combustion if any of the average CO ranges specified in Table 1<sup>7</sup> are detected in the gas furnaces and boilers flue gases for the durations listed.

**Table 1. CO ranges and durations for shut-down or modulation**

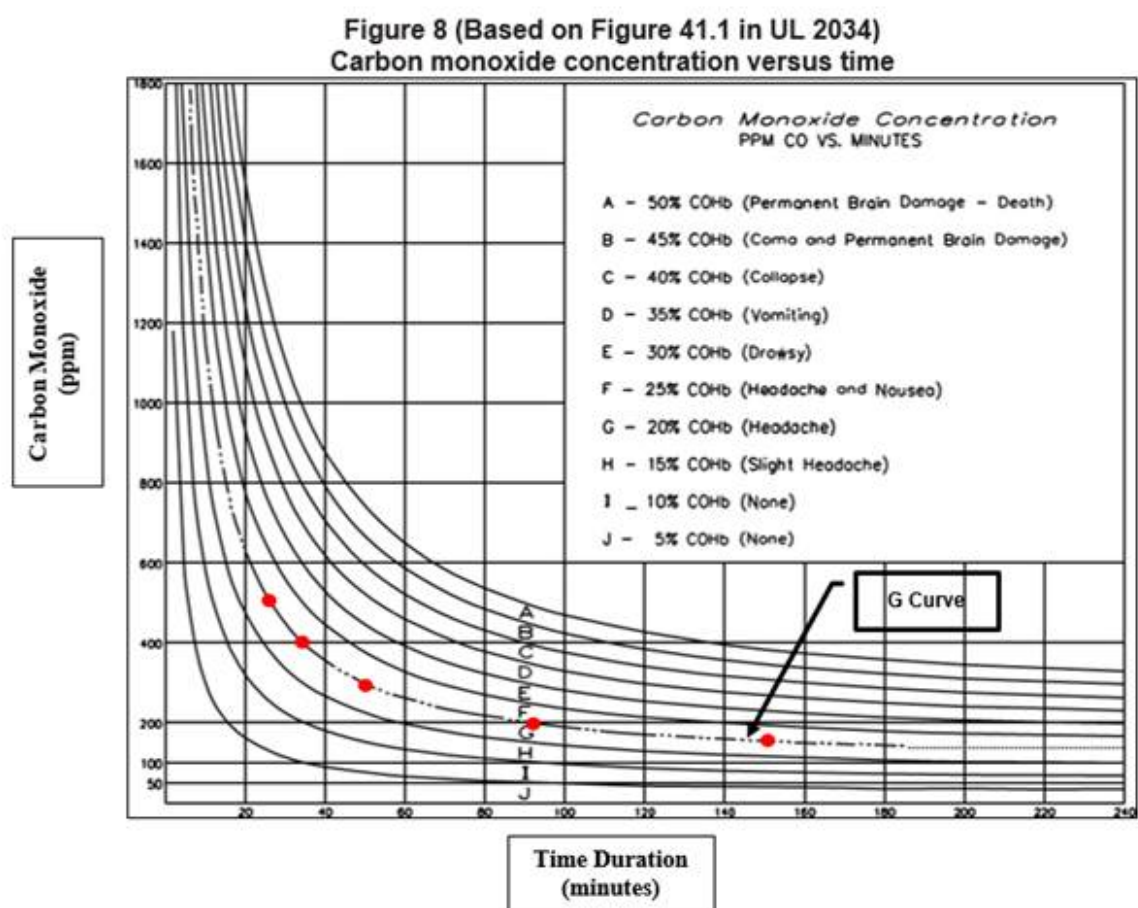
<b>Average CO (ppm)</b>	<b>Duration (minutes)</b>
500 or above	15
400-499	30
300-399	40
200-299	50
150-199	60

The average CO ranges in Table 1 are the proposed setpoints and durations at which a gas furnace or boiler must either shut down or begin modulation. These CO ranges are based on Curve G of the CO Concentration vs. Time graph (Figure 41.1 from UL 2034) in Figure 8 which

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<sup>7</sup> The proposed CO range setpoints and durations reflected in Table 1 are derived from UL 2034, Standard for Safety Single and Multiple Station Carbon Monoxide Alarms, 4<sup>th</sup> Edition, (2017), the voluntary standard for in-home carbon monoxide alarms. UL 2034 provides requirements for electrically operated single and multi-station CO alarms intended for protection in ordinary indoor locations of dwelling units. Section 41.1 of UL 2034 provides the levels at which a carbon monoxide alarm must trigger. Section 1.2 of UL 2034 covers carbon monoxide alarms intended to respond to the presence of carbon monoxide from various sources, including the abnormal operation of fuel-fired appliances.

indicates what an individual's carboxyhemoglobin (COHb) levels would be if exposed to various CO concentrations and the time of exposure needed to reach that COHb level. Curve G represents a 20 percent COHb level and the onset of health effects in individuals (*i.e.*, a headache). The values on the y-axis represent CO exposure levels in parts per million (ppm) from zero ppm CO to 1800 ppm CO. The values on the x-axis represents the time durations (in minutes) of exposure to the CO concentrations presented on the y-axis. The curves A through J on the graph represent the various carboxyhemoglobin levels an individual can reach when exposed to CO (y-axis) over a period of time (x-axis).



To interpret the graph in Figure 8, begin at a given CO concentration on the y-axis and extend a horizontal line to the right until the line intersects a COHb curve. At the point of intersection, extend a vertical line downwards to the x-axis. The time value at this point of intersection represents the amount of time, at the selected CO concentration, at which an individual would reach a certain COHb level. For example, at a 400 ppm CO concentration, it

would take approximately 35 minutes for an individual to reach a COHb of 20 percent. At a CO concentration of 300 ppm, it would take approximately 50 minutes to reach a COHb of 20 percent. The dots on the graph in Figure 8 illustrate that the entire proposed CO response range (*i.e.*, 150 - 400 and above) all fall on Curve G. A performance requirement that requires shutdown or modulation of a gas furnace or boiler at this range of CO levels provides protection to consumers from the onset of the more serious CO-related health effects, such as vomiting, coma, and death. The proposed performance requirement for the range and time period for CO exposure is consistent with the existing UL 2034 standard for consumer carbon monoxide alarms, which uses similar requirements to protect consumers from CO exposure in the home.

Manufacturers may comply with the performance requirements under the proposed rule by using an option for either shut down or modulation of the gas furnace or boiler if the average CO level reaches 150 ppm over a 15-minute duration. This option simplifies the performance requirement to a single CO setpoint rather than multiple setpoints as described above. It provides the same level of protection as the multiple setpoint approach described above because the gas furnace or boiler would be required to shut down or modulate at the lowest threshold of CO production (150 ppm) that can result in low-level health effects (*i.e.*, headache per the 20 percent COHb curve). The shorter time duration (15 minutes) is protective at higher CO concentrations of 200 ppm or more that can begin to cause the onset of health effects (*i.e.*, a headache per the 20 percent COHb curve).

The proposed performance requirements described in section VIII of the preamble are also based, in part on, on the definitions and performance requirements in ANSI Z21.47, *Standard for Gas-fired central furnaces*; ANSI Z21.13, *Standard for Gas-fired low pressure steam and hot water boilers*, and ANSI Z21.86, *Standard for Vented gas-fired space heating appliances*, as well as performance requirements from CEN<sup>8,9</sup> standards for domestic gas boilers,

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<sup>8</sup> EN 15502-2-1, *Gas-fired central heating boilers, Part 2-1: Specific standard for type C appliances and Type B2, B3 and B5 appliances of a nominal heat input not exceeding 1 000 kW*.

<sup>9</sup> EN 15502-2-2, *Gas-fired central heating boilers Part 2-2: Specific standard for type B 1 appliances*.

and CEN standards for safety and control devices for gas appliances<sup>10,11</sup> and gas/air ratio controls for gas appliances,<sup>12</sup> and JIS standard for domestic gas water heaters, boilers and space heaters.<sup>13, 14, 15</sup> The CEN and JIS standards were given weight when developing the proposed performance requirements because the provisions in these standards are similar to the proposed performance requirements for gas furnaces and boilers in this NPR and are readily applicable to U.S. gas furnaces and boilers. In addition, although there are significant differences between the design platforms of European and Japanese gas boilers (*i.e.*, predominantly premix power burner designs) and U.S. gas furnaces and boilers (*i.e.*, predominantly induced draft and some atmospheric vent designs), the basic operating environment parameters (e.g., temperature, humidity, and combustion gases) within the heat exchangers and flues of European and Japanese gas boilers and U.S. gas furnaces and boilers are similar. The European and Japanese circumstances demonstrate the commercial availability of CO/combustion sensors and combustion controls that: (1) provide CO/combustion sensor-based shutoff or reduced CO through combustion control; (2) are durable enough to survive in heat exchangers or flues of gas appliances; and (3) can be applied for use in U.S. gas furnaces and boilers.

The proposed rule provides test methods to introduce a simulated 400 ppm, 300 ppm, 200 ppm, and 150 ppm CO emission level into the exhaust gas to determine if the safety system passes or fails the proposed performance requirements.

As explained in Tab B of the Staff NPR Briefing Package, staff assesses that the proposed rule would be 90 to 100 percent effective in preventing CO deaths and injuries associated with gas furnaces and boilers, because CO production at the gas furnace and boiler would be limited to levels that produce a headache in exposed consumers. Staff's assessment is

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<sup>10</sup> BS EN 13611, Safety and control devices for burners and appliances burning gaseous and/or liquid fuels — General requirements.

<sup>11</sup> BS EN 16340, Safety and control devices for burners and appliances burning gaseous or liquid fuels — Combustion product sensing devices.

<sup>12</sup> Gas/air ratio controls for gas burners and gas burning appliances — Part 2: Electronic types

<sup>13</sup> JIS-S-2109, *Gas burning water heaters for domestic use.*

<sup>14</sup> JIS-S-2112, *Gas hydronic heating appliances for domestic use.*

<sup>15</sup> JIS-S-2122, *Gas burning space heaters for domestic use.*

based on the following key metrics used to assess the capability of the performance requirement in protecting consumers from the identified CO exposure risks:

- Detecting CO at the source of production: This provides a greater level of protection to consumers than residential CO alarms because it detects CO at the source of production within the gas furnace or boiler, before it leaks into a dwelling space, and allows for an earlier response time to protect consumers.
- Prevents or limits production of harmful levels of CO: Shutoff or modulation of the gas furnace or boiler directly addresses harmful CO production.
- Selecting CO response concentrations that fall on the 20 Percent COHb curve: Selecting multiple CO response concentrations or a single, threshold CO concentration (150 ppm or higher) limits the severity of any potential health effects to a headache (*i.e.*, the 20 percent COHb curve).
- Addresses all known hazard patterns: Although the performance requirements do not prevent combustion product (including CO) leakage, the requirements do protect against serious harm from leakage of combustion products by limiting/preventing CO production.

## **VII. Response to Comments**

In response to the Commission's 2019 ANPR regarding residential gas furnaces and boilers, CPSC received 15 comments from the public, divided between supporters and opponents of the proposal. Opposing comments came primarily from the gas appliance industry. The comments can be found under docket number CPSC-2019-0020, at: [www.regulations.gov](http://www.regulations.gov).

Below is summary of the comments and CPSC's responses by topic area.

### Alternatives to Performance Requirements

*Comment:* Nine commenters (A.O Smith, Carrier, Crown, Rheem, US Boiler Co. Edward Johan (USBC EJ), US Boiler Co. John Busse (USBC JB), Air Conditioning, Heating, and Refrigeration Institute (AHRI), Strauch, and Stanonik) asserted that rulemaking is not necessary

because residential CO alarms will prevent CO poisoning from gas appliances. One commenter (Stanonik) further claimed that information from CPSC's IDI reports show that CO alarms are effective in protecting participants from exposure to hazardous levels of CO and that a survey being conducted by CPSC should be completed before rulemaking occurs. Four commenters (Crown, USBC EJ, USBC JB, and AHRI) supported changing the ANSI gas appliance standards and/or building codes to require CO alarm installation.

*Response:* CPSC lacks statutory authority to mandate that consumers install CO alarms in their homes. Although the Commission urges use of residential CO alarms, not all homes are equipped with functioning and maintained CO alarms, and fewer still have them in all occupied spaces into which CO may leak from a gas furnace or boiler. Despite CPSC, state and local governments, and the private sector information and education campaigns to increase the use of CO alarms, injuries and fatalities that occur annually are evidence that this hazard continues to kill and injure consumers, supporting the view that effective performance requirements for gas appliances are critical to consumer safety.

*Comment:* USBC JB stated that a CO monitor in the equipment room or living space would provide a better solution than a CO monitor on the appliance.

*Response:* A monitoring system located within the equipment room or living space would not necessarily detect CO at all foreseeable points of potential leakage along the length of the vent system. In contrast, detecting excessive CO leakage at the point of production on the appliance would protect consumers from CO exposure, regardless of the point or mechanism of leakage, or the cause of elevated CO production.

*Comment:* USBC JB stated that CPSC should sponsor and provide funding for a multi-functional task force to develop solutions to reduce and eliminate CO poisoning caused by residential gas furnaces and boilers.

*Response:* CPSC has contributed extensively to the development of proposed solutions to the CO hazard from gas furnaces and boilers. Staff's memorandum in Tab D of the Staff ANPR

Briefing Package summarizes CPSC staff's efforts from 2000 to 2019 to work with the ANSI Z21/T83 Technical Committee to address carbon monoxide poisoning that was continuing to occur despite revisions to the gas appliance standards. CPSC staff conducted research and shared the results of that research, along with incident reports, with the Committee. Staff also submitted two proposals to the Technical Committee (in 2000 and 2015) requesting that the relevant voluntary standards add requirements to address the production of hazardous levels of CO and the risk of that CO entering the living space of a dwelling. Despite staff's efforts over two decades, as well as the developments of voluntary standard requirements in Japan and Europe, the U.S. voluntary standards community has not adequately addressed the CO risk at the source of production in gas appliances. Indeed, in 2019 the Technical Committee disbanded the working group assessing possible revisions to the standards.

*Comment:* USBC JB predicted that gas furnaces and boilers will eventually be replaced with electric heating appliances because current and future efforts to reduce carbon emissions will eliminate or restrict the availability of natural gas for residential appliances.

*Response:* Gas appliances and boilers continue to be sold in large numbers for residential heating in the United States, without an effective voluntary solution to the CO hazard. Therefore, the Commission preliminarily concludes that mandatory performance requirements to address CO production by gas furnaces and boilers are necessary to reduce deaths and injuries from CO exposure that otherwise will continue to occur.

*Comment:* USBC JB referred to periodic inspection and service of gas appliances and asked if CPSC's data addresses whether "formalized inspection and service requirements would reduce carbon monoxide poisoning." Two other commenters (Crown and AHRI) asserted that a formal program to check installation, service, and maintenance will reduce carbon monoxide incidents.

*Response:* CPSC lacks statutory authority to mandate homeowners' spending for maintenance services. Further, CPSC staff is not aware of data indicating that maintenance alone



can address the deadly CO hazard from gas furnaces and boilers. Manufacturers already recommend routine maintenance of furnaces and boilers, yet injuries and deaths continue to occur for the reasons described above.

*Comment:* Crown and USBC JB asserted that CPSC should rely on recalls to prevent/reduce CO incidents involving gas boilers and furnaces.

*Response:* When a product is subject to a CPSC recall, the product already may have been involved in an incident, in this case a CO exposure incident that may have caused serious injury or death. The CPSC will continue to utilize the CPSA section 15 recall process, independent of this rulemaking, but it is not a substitute for the proposed rule, which addresses elevated CO levels that may be unrelated to a defect in the furnace or boiler itself.

#### Rely on Consumer or Installer Education

*Comment:* Carrier, Crown, Rheem, USBC EJ, and USBC JB stated that information and education programs for consumers, installers, and maintenance personnel will adequately address CO poisoning hazards.

*Response:* Information and education campaigns currently exist, and yet numerous deaths and injuries continue to occur due to CO poisoning from gas furnaces and boilers demonstrating that these campaigns do not adequately address the hazard.

Warnings rely on educating consumers about the hazard and persuading consumers to alter their behavior in some way to avoid the hazard. To be effective, warnings also depend on consumers noticing or otherwise receiving the message, attending to the message, remembering the recommended behaviors when needed, and behaving consistently, regardless of situational or contextual factors that influence precautionary behavior, such as fatigue, stress, or social influences. Thus, providing warnings and instructions about hazards is less effective than either designing the hazard out of a product or guarding the consumer from the hazard.

#### Rely on Voluntary Standards

*Comment:* Commenters A.O. Smith, Rheem and the National Propane Gas Association

(NPGA) stated that the CPSC should work with voluntary standards organizations to address the hazard.

*Response:* Tab D of the Staff ANPR Briefing Package summarizes CPSC staff's efforts from 2000 to 2019 to work with the ANSI Z21/T83 Technical Committee to address carbon monoxide poisoning incidents. As described above, despite staff's efforts, the voluntary standards organizations have not adopted adequate performance requirements to address the hazard.

*Comment:* Carrier and AHRI noted that current appliance designs certified to the applicable ANSI/CSA Z21 safety standards already incorporate several safety features that reduce the risk of carbon monoxide production. These include blocked vent/intake switches, draft hood spill switches, and flame roll-out switches. Another commenter (USBC JB) stated that the ANSI standard for direct and non-direct vent boilers includes a test method to limit CO levels when the flue outlet is blocked or partially blocked, which USBC JB believes addresses the impact of snow blocking the vent. Stanonik stated that two-pipe or direct vent systems have fewer CO risks and some atmospherically vented appliances are not susceptible to depressurizing and back drafting that lead to CO exposure in the living space, and that these features, combined with the proper installation, service, and maintenance of the appliances, would eliminate the CO risk.

*Response:* Blocked vent/intake pressure switches, draft hood spill switches, and flame rollout switches are all requirements that were added to and became effective in the standards between 1987 and 1993. Yet injuries and deaths from CO poisoning have continued to occur despite the existence of these voluntary standards provisions. Indeed, as discussed in Tab B of the Staff NPR Briefing Package, the particular voluntary standards provisions cited by these commenters have failed to prevent deaths and injuries in real-world scenarios.

Adverse/Unintended consequences of shut-off triggered by CO sensor

*Comment:* Six commenters (Carrier, Crown, USBC EJ, USG JB, AHRI, and Strauch)

stated that improper shut-down of a gas appliance by a CO sensor will cause a no-heat hazard for consumers.

*Response:* In response to these comments and other staff analyses, the proposed rule would require a fail-safe provision that would operate for the life of the appliance. If a CO sensor, combustion sensor, combustion control system, or other device designed to meet these requirements, fails to operate properly or at all, then the appliance shall shutdown and restart after 15 minutes, repeating this cycle and continuing to provide heat until the failed component is replaced, while also alerting the consumer of the hazard. For the life of the gas furnace or boiler, the proposed fail-safe provision would be required to notify consumers and service technicians of device failure by either a flashing light, or other appropriate code on the appliance control board, that corresponds to the device failure.

*Comment:* Crown stated that a shut-down central heating appliance may encourage the use of less safe heating alternatives.

*Response:* Shut-off devices on gas furnaces and boilers (e.g., BVSS, flame rollout switches, and over temperature limit switches) have been required by the ANSI Z21 standards for 25 to 30 years. However, we are not aware of any trends of consumers using less safe heating alternatives as the result of these other safety shut-down devices on these products. Furthermore, the proposed rule has a fail-safe provision, as described above, which provides warning to consumers of a CO sensor issue without complete loss of functionality of the gas furnace or boiler.

#### Carbon monoxide sensor – Sensitivity and Durability

*Comment:* American Gas Association (AGA) and USBC JB asserted that measuring “air-free” CO concentrations benchmarked to the ANSI-recognized “safe” concentration of 400 ppm would be complex because a carbon monoxide monitor measures “raw” CO concentrations which includes the “air-free” carbon monoxide concentration multiplied by the ratio of air that was not used in combustion. Consequently, the air-free CO will always be lower than the

measured CO.

*Response:* CPSC staff agrees that an air-free measurement calculation would be more complex since it would require the measurement of carbon dioxide or oxygen as well, and the proposed rule does not require this calculation.

*Comment:* USBC JB stated that the performance of existing CO sensors has not been established at the 400 ppm level and lower.

*Response:* In general, sensor manufacturers specify the maximum and minimum concentration range that a sensor can detect, as well as whether the sensor provides a linear output voltage in response to the gas (*i.e.*, CO) it's designed to detect. For example, if a manufacturer specifies that their sensor has a linear response range of 0 to 10,000 ppm of CO, then the sensor can detect between 0 and 10,000 ppm CO, including 400 ppm CO or lower. CPSC staff has identified multiple CO sensors with an advertised linear response range that extends below 400 ppm.

*Comment:* Strauch asserted that research does not show that CO sensors are durable enough to last for 15 to 20 years. Another (USBC JB) stated that performance requirements normally address device tolerances to allow conformance at prescribed conditions and avoid nuisance issues.

*Response:* We do not agree with the premise that CO sensors must have a 15-to-20 year lifespan in order for the proposed rule to be effective. Many parts may fail during the lifetime of a gas furnace or boiler, resulting in the need for replacement or a service call to fix or replace the part. CO sensors would be expected to be treated in this same manner as other parts that need to be replaced during the lifespan of the product. The costs of such services are included in the preliminary regulatory analysis in section IX of the preamble. Regarding the comment about tolerances, manufacturers will need to select appropriate sensors and other equipment to ensure that their furnaces and boilers comply with the proposed standard.

#### Requirements in International Standards

*Comment:* Crown and USBC JB asserted that there is no widespread use of CO sensors in gas appliances in Europe and Japan. One commenter (AHRI) observed that “the EN standards (EN 15502-1, EN 15502-2-1 and EN 15502-2-2) do not require manufacturers to incorporate a CO-sensor shut-off device within the appliance.” In addition, that commenter stated none of the U.S. or international standards, including JIS S 2019, specifically require a CO sensor within the appliance. AHRI stated that the most commonly used CO sensor, manufactured by Nemoto Sensor Engineering, Ltd., is designed to work when carbon monoxide levels exceed 1000 ppm.

*Response:* While the Japanese standard, JIS S 2019, and the European standards, EN 15502-2-1 and EN 15502-2-2, do not specifically require a CO sensor in-situ (*i.e.*, within the heater exchanger or flue passage ways of the appliance), each standard includes an option that allows for CO and combustion sensors in-situ if the manufacturer chooses to use that approach to meet the requirements of the respective standards. Some European and Japanese gas boilers products certified to those standards are equipped with CO sensor shutoff capability. More generally, the existence of the option to use CO sensors incorporated in-situ to meet the requirements of respective standards reinforces that such sensors are feasible. Regarding Nemoto sensors, the published Nemoto product literature (<https://sensor.nemoto.co.jp/en/product/detail/nap-78su/>) indicates that the CO sensors in question have a linear response range of zero to 10,000 ppm CO; thus the sensors in question are represented by Nemoto to have the capability to provide an output voltage response to all of the CO levels within that range, including 400 ppm CO and lower.

#### Feasibility of performance requirements with existing CO/Combustion technology

*Comment:* Carrier and AHRI stated that “a minimum of 20 years is needed to replace existing residential gas appliances with a carbon monoxide sensor-equipped appliances” based on the anticipated lifespan of an appliance. USBC JB stated that it would take a minimum of two to three years to develop and validate performance requirements and then revise the voluntary standards through the consensus process.

*Response:* We agree that it will take time for existing gas furnaces and boilers to be replaced by newly installed equipment that meets the requirements of the proposed rule mandating additional safety features for future gas furnaces and boilers; inasmuch as the proposed rule does not require replacement of existing installed gas furnaces and boilers and would only apply to the future manufacture of gas furnaces and boilers. This is reflected in the preliminary regulatory analysis in Section IX of the preamble. Approximately two million gas furnaces and 800,000 gas boilers without CO sensors are sold each year, thus prolonging the time it would take to replace old stock. As a result, each year of further delay in instituting safety features to address the CO hazard will result in millions of units without these features being sold and installed and remaining in homes for multiple decades, risking additional preventable deaths and injuries.

*Comment:* Carrier and AHRI stated that CO sensors will not detect leakage from the venting system.

*Response:* The proposed rule focuses on the source rather than leakage points throughout the exhaust path because of the extent, variability, and potential inaccessibility of the exhaust path in homes. We agree that a CO sensor will not detect leakage from a venting system. However, CO detection at the source of production would provide protection to consumers regardless of the location of downstream leakage. For these reasons, we disagree with AHRI's assertion that a CO sensor-equipped appliance would be ineffective against a compromised vent.

*Comment:* A.O. Smith stated that CO sensors in a gas appliance cannot easily be replaced in the field.

*Response:* The commenter provided no technical evidence to support the claim that CO sensors cannot be installed so that they are easily replaced in the field. CPSC staff is aware of and has access to gas appliances that utilize CO sensors, air/fuel ratio sensors, and other combustion control devices within the combustion chamber of flue passageways to provide CO safety and/or energy efficiency. CO sensors are no more complex and do not present any greater

difficulty in gaining access to the devices for maintenance or replacement than other safety devices, such as pressure switches, flame sensors, and flame rollout switches, currently required by the ANSI standards for gas appliances. Sensors are comprised of a sensing element covered by shielding and a mounting flange. Typically, the shielded, sensing element is inserted through an access hole through the bulkhead of a combustion chamber, plenum, or flue passageway. The sensor is generally mounted to the bulkhead with two screws with a heat-resistant gasket between the mounting flange and the bulkhead. We assess that CO sensors in a gas appliance could be replaced in consumer homes in a manner similar to other existing gas furnace or boiler components that are currently serviced and replaced in consumer homes.

*Comment:* Rheem asserted that some of the referenced/observed failure modes in the ANPR cannot be addressed through appliance design alone.

*Response:* We do not agree with the assertion that failure mode issues cannot be addressed through appliance design. By ensuring that harmful levels of CO are not produced in the gas furnace or boiler, the proposed requirements remove the need to provide protection throughout the entire exhaust vent system.

*Comment:* Stanonik stated that the document “Findings from CPSC’s 2014 Carbon Monoxide/Combustion Sensor Forum and Request for Information” ([https://www.cpsc.gov/s3fs-public/pdfs/blk\\_pdf\\_Findings-from-the-FY14-Sensor-Forum-and-RFI.pdf](https://www.cpsc.gov/s3fs-public/pdfs/blk_pdf_Findings-from-the-FY14-Sensor-Forum-and-RFI.pdf)) indicates that a specific sensor technology that appeared to address durability and longevity concerns is very expensive and reflected the “significant process” involved in developing durable and reliable sensor products.

*Response:* We agree that the cost the commenter referenced would be high. However, the sensing technology in question was an evaluation unit, not a full-scale production unit, and came with electronic controls necessary to operate and evaluate the sensor, resulting in elevated costs for that particular sensing technology. The cost per unit typically goes down with large-scale production. CPSC staff estimates costs for volume purchases in the range of approximately \$5 to

\$15 per unit. The preliminary regulatory analysis in section IX of the preamble provides further analysis of potential costs and benefits.

## **VIII. Description of the Proposed Rule**

The proposed rule would create a new part 1408, “Safety Standard for Residential Gas Furnaces and Boilers.” The provisions of the proposed rule are described below.

### *A. Proposed section 1408.1 Scope, purpose, and effective date*

Proposed section 1408.1 provides that new part 1408 establishes a consumer product safety standard that would provide performance requirements for residential gas furnaces and boilers that are consumer products used to heat dwellings. The purpose of these requirements is to reduce the occurrence of carbon monoxide-related deaths, injuries, and exposures associated with gas furnaces, boilers, and wall and floor furnaces. All requirements of the proposed rule apply to all residential gas furnaces, boilers, and wall and floor furnaces that are manufactured after the proposed effective date, which is 18 months after publication of the final rule in the *Federal Register*.

### *B. Proposed section 1408.2 Definitions*

Proposed section 1408.2 provides definitions that apply for purposes of part 1408. Proposed section 1408.2 provides definitions for the covered categories of furnaces and boilers. The proposed definitions are based on the definitions used in ANSI Z21.47-2021, ANSI Z21.13-2022, and ANSI Z21.86-2016 for the same product types.

### *C. Proposed section 1408.3 Performance requirements for gas furnaces and boilers*

Proposed section 1408.3 provides general requirements, performance requirements, test configuration, and test methods for all residential gas furnaces and boilers. Section VII.B of the preamble provides the technical justification for these proposed requirements.

#### 1. Proposed section 1408.3(a) (general requirements)

Proposed section 1408.3(a) provides that all residential gas furnaces and boilers must have a means to either directly or indirectly monitor the concentration of carbon monoxide



produced during the combustion process and shut down or modulate combustion to reduce average CO concentrations to below the CO levels for the durations of time specified in proposed section 1408.3(b). The gas furnace or boiler must either shut down or modulate combustion to reduce average CO emissions to below 150 ppm if the average CO emissions reach or exceed the CO limits and time durations specified in section 1408.3(b).

Proposed section 1408.3(a) also states that indirect monitoring and control of CO emissions can be accomplished by monitoring and controlling other combustion parameter(s) that accurately correlate to the production of CO. Proposed section 1408.3(a) provides examples of parameters that can serve as a proxy for CO production such as carbon dioxide (CO<sub>2</sub>), oxygen (O<sub>2</sub>), the Gas/Air Ratio, and the flame ionization current produced by the burner flame.

## 2. Proposed section 1408.3(b) (performance requirements)

Proposed section 1408.3(b) provides a performance requirement that a gas furnace or boiler must be equipped with a means to continuously monitor CO emission and must meet the requirements described in either proposed section 1408.3(b)(1) or (b)(2) (direct means to monitor CO emissions) or (b)(3) or (4) (indirect means to monitor CO emissions) when tested using the test method described in proposed section 1408.3(d). Proposed paragraphs 1408.3(b)(1) and (2) provides two options for gas furnaces and boilers manufacturers to use direct means to monitor CO emissions that must cause either shut-down or modulation of the gas furnace or boiler combustion, based on conditions within the gas furnace or boiler for a range of specified average CO concentrations for the specified time frames. Proposed section 1408.3(b)(3) provides two options for gas furnace and boiler manufacturers to use an indirect means to monitor CO emissions that must either cause shut-down of the gas furnace or boiler or cause modulation of combustion of the gas furnace or boiler, based on conditions within the gas furnace or boiler for a range of specified average CO concentrations for the specified time frames described.

Proposed section 1408.3(b)(4) provides a fail-safe requirement that during the life of the gas furnace or boiler, if a CO sensor, combustion sensor, combustion control system, or other

device designed to meet these requirements fails to operate properly or at all, then the gas furnace or boiler must shutdown and restart after 15 minutes and repeat this cycle until the failed component is replaced. The requirement mandates that consumers and service technicians must be notified of device failure by either a flashing light, or other appropriate code on the gas furnace or boiler control board, that corresponds to the device failure.

### 3. Proposed section 1408.3(c) (test configuration)

Proposed section 1408.3(c) describes the requirements that gas furnace or boilers must be configured in accordance with the provisions of the combustion sections of the respective voluntary standards (section 5.8.1 of ANSI Z21.47-2021 for gas furnaces; section 5.5.1 of ANSI Z21.13-2022 for gas boilers; and sections 9.3.1, 11.2.1, and 13.3.1, of ANSI Z21.86-2016 for gas wall and floor furnaces) with respective instruction on how products are to be configured before testing to proposed section 1408.3(d).

### 4. Proposed section 1408.3(d) (test procedure)

Proposed section 1408.3(d) provides the test procedure to be used to test a gas furnace or boiler after the product has been configured pursuant to proposed section 1408.3(b) to demonstrate compliance with the performance requirements provided in proposed section 1408.3(b).

#### *D. Proposed section 1408.4 Incorporation by reference*

Proposed section 1408.4 incorporates by reference ANSI Z21.47-2021, ANSI Z21.13-2022, and ANSI Z21.86-2016 regarding the test setup cited in proposed section 1408.3 and provides information on where the standards are available.

#### *E. Proposed section 1408.5 Prohibited stockpiling*

Pursuant to section 9(g)(2) of the CPSA, 15 U.S.C. 2058(g)(2), the proposed rule would prohibit a manufacturer from “stockpiling” or substantially increasing the manufacture or importation of noncompliant gas furnaces and boilers between the date publication of the final rule and the effective date. The provision, which is explained more fully in Tab D of the Staff

NPR Briefing Package, would prohibit the manufacture or importation of noncompliant products at a rate that is greater than 106 percent of the base period in the first 12 months after promulgation, and 112.50 percent of the base period for the duration of 12 months after promulgation until the effective date. The base period is defined in the proposed rule as the calendar month with the median manufacturing volume, among months with manufacturing volume, during the last 13 months prior to the rule's publication.

We propose a rate of 106 percent for the first 12 months and a rate 112.50 percent in the final 6 months between publication and effective date based on the historical growth of the industry. We propose a higher rate of 112.50 percent for the second year to account for the baseline growth of the industry in the second year.

Individual manufacturers may experience growth rates outside the historical range. Shipment data for gas furnaces and boilers show a steady, yet seasonal, market. Shipments of gas furnaces and boilers begin to rise in March and continuously increase until December, after which they fall off sharply. The Commission seeks public comment on manufacturing, the seasonality of sales, and supply chain of gas furnaces and boilers to further understand these topics.

#### *F. Appendix A to Part 1408 – Findings Under the Consumer Product Safety Act*

The findings required by section 9 of the CPSA are discussed throughout this preamble and set forth in Appendix A to the proposed rule.

### **IX. Preliminary Regulatory Analysis**

Pursuant to section 9(c) of the CPSA, publication of a proposed rule must include a preliminary regulatory analysis containing:

- A preliminary description of the potential benefits and potential costs of the proposed rule, including any benefits or costs that cannot be quantified in monetary terms, and an identification of those likely to receive the benefits and bear the costs;

- a discussion of why a relevant voluntary safety standard would not eliminate or adequately reduce the risk of injury addressed by the proposed rule; and
- a description of any reasonable alternatives to the proposed rule, together with a summary description of their potential costs and benefits and why such alternatives should not be published as a proposed rule.

This preamble contains a summary of the preliminary regulatory analysis for the proposed rule.

Tab D of the Staff NPR Briefing Package contains a detailed analysis.

#### *A. Market Information*

##### 1. The Product

Gas furnaces and boilers are vented gas heating appliances that heat residential dwellings. Section III of the preamble provides a detailed discussion of the nature and operation of gas furnaces and boilers. The average product life for gas furnaces and boilers ranges from approximately 22 to 25 years.

Gas furnaces and boilers include central warm-air furnaces and boilers as well as floor, and wall furnaces.

- Central warm-air furnaces and boilers use a central combustor, or boiler, to heat air using natural gas, and liquid propane. Some of these furnaces move the heated air using a blower or fan through ducts while others rely on the natural flow of warm air going up and cold air down to circulate air. Most boilers supply steam or hot water through conventional radiators or baseboard radiators.
- Floor and wall furnaces are less common than central furnaces and boilers and consist of ductless combustors to heat air. A floor furnace and wall furnace heat the physical parts of the house (*i.e.*, floor or wall) to heat the dwelling. A furnace is typically located in a basement and delivers heated air through a large register in the floor above it.

Consumers purchase gas furnaces and boilers primarily through contract installers, but they may also purchase units at retail stores and online retailers. CPSC staff estimate the average retail price of gas furnaces to be \$1,660 and \$3,719 for gas boilers.

## 2. Market Trends for Gas Furnaces and Boilers

Staff identified as many as 70 firms that manufacture or import residential gas furnaces and boilers. When accounting for subsidiaries and multiple brands provided by the same company, staff identified 20 parent firms. In 2016, the largest 10 firms by revenue accounted for 83.3 percent of heating equipment sales. Seven of these firms are based in the U.S.

Department of Energy's (DOE) most recent Residential Energy Consumption Survey (RECS) reports the total number of gas furnaces, gas boilers, and wall furnaces in-use to be 60.94 million in 2020. This is an increase from 57.90 million in 2015. Between 2015 and 2020, therefore, the number of in-scope gas furnaces and boilers grew at an average annual rate of 1.03 percent.

DOE's Government Regulatory Impact Model (GRIM) projects gas furnace sales in 2021 to be 3.58 million units and gas boilers to be 0.30 million units. CPSC staff estimated that residential gas furnaces and boilers sales in 2021 to be \$5.94 billion and \$1.12 billion, respectively.

CPSC staff estimate that residential gas boiler imports average \$117.67 million annually. The Commission requests comment on the value and quantity of gas furnaces and boilers imports that would be subject to a proposed rule.

## 3. Future Market Size for Gas Furnaces and Boilers

Staff used a 1.03 percent annual growth rate derived from DOE's GRIM to project sales into the future. Using this approach, staff estimates the number of in-use, in-scope gas furnaces and boilers will grow from 64.13 million in 2025 to 90.49 million in 2054.

### *B. Preliminary Description of Potential Costs and Benefits of the Rule*

Staff conducted a cost assessment of the proposed rule. The proposed rule would impose the following costs: increased variable costs of producing furnaces and boilers with CO sensors and shutoff capabilities; one-time conversion costs of redesigning and modifying factory operations for installing CO sensors; increased maintenance costs of gas furnaces and boilers to consumers; and deadweight loss<sup>16</sup> in the market caused by the increasing price due to regulation and the subsequent decline in sales. Staff performed a 30-year prospective cost assessment (2025-2054) on all four cost categories and estimated the total annualized cost from the proposed rule to be \$602.27 million, discounted at three percent.<sup>17</sup> Staff estimated the per-unit cost of a gas furnace or boiler from the proposed rule to be \$158.11, discounted at three percent.

Staff also conducted a benefits assessment of the proposed rule. The benefits assessment accounted for the prevention of deaths and injuries from compliant gas furnaces and boilers, which staff monetized using the Value of Statistical Life (VSL) for deaths, and the Injury Cost Model (ICM) for injuries. Over the 30-year study period, staff estimated the proposed rule would prevent 576 deaths (19.20 deaths per year) and 160,699 injuries (5,357 per year). The total annualized benefits from the proposed are \$356.52 million, discounted at three percent. Staff estimated the per-unit benefits from the proposed rule to be \$93.60, discounted at three percent. Staff calculates net benefits (benefits less costs) to be -\$245.74 million on annualized basis, discounted at three percent. The net benefits on per-unit basis are -\$64.51, discounted at three percent. Alternatively, this can be described as the proposed rule being a net cost of \$64.51 per gas furnace or boiler, which represents approximately three percent of the average price of a gas furnace or boiler, to prevent an estimated 576 deaths and 160,699 injuries over 30 years.

Finally, staff conducted a sensitivity analysis that showed if, by 2035 manufacturers were able to develop compliant gas furnaces and boilers with CO sensors that did not need

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<sup>16</sup> Deadweight loss is the value of lost transactions that may occur after major market events such as a new regulation.

<sup>17</sup> Staff uses a discount rate to incorporate the time value of money during the 30-year study period. In the analysis, staff presents both costs and benefits in undiscounted dollars, discounted at three percent, and discounted at seven percent.

replacement, and if the analysis took into account that a child's death is considered twice as costly as an adult death<sup>18</sup>, the benefit-cost ratio would increase to 0.78.

### *C. Evaluation of Voluntary Standards*

Based on staff's evaluation of the relevant ANSI standards discussed in section V of the preamble, the Commission preliminarily determines that current U.S. voluntary standards do not adequately address the hazard of CO exposure from gas furnaces and boilers. Further, the Z21/83 Technical Committee and the subordinate Technical Subcommittees have no clear plan to address these hazards in the relevant voluntary standards. None of the commenters on the ANPR submitted any recommendations for proposed requirements, nor did any commenters submit an existing voluntary standard or a portion of one that would adequately address the CO exposure risk that this proposed rule would address. No standard or portion of a standard was submitted to the Commission under section 9(a)(5) of the CPSA.

### *D. Alternatives to the Proposed Rule*

The Commission considered four alternatives to the proposed rule: (1) continue to work and advocate for change through the voluntary standards process; (2) rely on the use of residential CO alarms; (3) continue to conduct education and information campaigns; and (4) rely on recalls. Each alternative is discussed in detail below.

#### 1. Continue to work and advocate for change through the voluntary standards process

Section V of this preamble highlights CPSC staff's participation in the voluntary standard development process for ANSI Z21.47, Z21.13, and Z21.86. Despite staff encouraging industry to adopt a standard that adequately addresses the hazard, and providing industry with the

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<sup>18</sup> For more information see CPSC's Draft Guidance for Estimating Value per Statistical Life (88 FR 17826), <https://www.federalregister.gov/documents/2023/03/24/2023-06081/notice-of-availability-proposed-draft-guidance-for-estimating-value-per-statistical-life>.

necessary factual foundation, industry has not adopted such a standard in over 20 years. For this reason, the Commission is not adopting this alternative.

## 2. Rely on the use of residential CO alarms

CPSC has long promoted CO alarm adoption and states have increasingly required CO alarms in homes over the last two decades. Yet there has not been a significant decline in CO injuries and fatalities, demonstrating that CO alarm adoption alone is insufficient to address the hazard. We also note that residential CO alarms may fail to alert due to battery failure, poor maintenance, manufacturer defect, age, incorrect installation, or defects. Finally, a CO alarm would not shut down a gas furnace or boiler producing a dangerous amount of CO and thus would require the occupant to properly recognize what to do when the alarm is triggered. For these reasons, the Commission is not adopting this alternative.

## 3. Continue to conduct education and information campaigns

Despite education and information campaigns by CPSC and others regarding CO hazards, CO death and injuries for gas furnaces and boilers remain high. Education and information campaigns alone have not adequately addressed the CO hazard from gas furnaces and boilers in the absence of a performance standard. For these reasons, the Commission is not adopting this alternative.

## 4. Rely on recalls

Although not all instances of excessive CO concentrations result from a defect in the gas furnace or boiler, the Commission could seek voluntary or mandatory recalls of gas furnaces and boilers that present a substantial product hazard. Recalls only apply to an individual manufacturer and product, and generally do not extend to similar products, and occur only after consumers have purchased and used such products with possible resulting deaths or injuries due to exposure to the hazard. Additionally, recalls can only address products that are already on the market but do not directly prevent unsafe products from entering the market. In the absence of a rule, hazardous gas furnaces and boilers will continue to see sales of several million units



annually and the stock of hazardous products will continue to grow. Additionally, while detached gas furnaces and boilers could be easily recalled, installed gas furnace and boiler recalls can be disruptive and costly. For these reasons, the Commission does not choose this alternative.

## **X. Initial Regulatory Flexibility Analysis**

Whenever an agency publishes an NPR, Section 603 of the Regulatory Flexibility Act (RFA), 5 U.S.C. 601–612, requires the agency to prepare an initial regulatory flexibility analysis (IRFA), unless the head of the agency certifies that the rule will not have a significant economic impact on a substantial number of small entities. The IRFA, or a summary of it, must be published in the *Federal Register* with the proposed rule. Under Section 603(b) of the RFA, each IRFA must address:

- (1) a description of why action by the agency is being considered;
- (2) a succinct statement of the objectives of, and legal basis for, the proposed rule;
- (3) a description of and, where feasible, an estimate of the number of small entities to which the proposed rule will apply;
- (4) a description of the projected reporting, recordkeeping, and other compliance requirements of the proposed rule, including an estimate of the classes of small entities which will be subject to the requirement and the type of professional skills necessary for preparation of the report or record; and
- (5) an identification, to the extent practicable, of all relevant Federal rules which may duplicate, overlap, or conflict with the proposed rule.

The IRFA must also describe any significant alternatives to the proposed rule that would accomplish the stated objectives and that minimize any significant economic impact on small entities.

### *A. Reason for Agency Action*

The intent of this rulemaking is to reduce deaths and injuries resulting from carbon monoxide leaks from gas furnaces and boilers by establishing a mandatory performance standard

requiring gas furnaces and boilers to shut off or modulate when CO levels reach specified amounts for a certain duration.

*B. Objectives of and Legal Basis for the Rule*

The Commission proposes this rule to reduce the risk of death and injury associated with CO leakage from residential gas furnaces and boilers. This standard is promulgated under the authority of the CPSA. To issue a mandatory standard under CPSA section 7, 15 U.S.C. 2056, the Commission must follow the procedural and substantive requirements in section 9 of the CPSA, 15 U.S.C. 2058. *See* 15 U.S.C. 2056(a).

*C. Small Entities to Which the Rule Will Apply*

The proposed rule would apply to all manufacturers and importers of gas furnaces and gas boilers. CPSC staff is aware of as many as 70 firms manufacturing gas furnaces and boilers for the U.S. market. When accounting for subsidiaries and multiple brands provided by the same company, staff identified 20 parent firms.

Using SBA guidelines, staff identified two small manufacturers of gas furnaces, three small manufactures of residential gas boilers, and one importer of gas furnaces that may fall within the scope the rule. The Commission requests comment on additional manufacturers and importers of gas furnaces and boilers that may meet the SBA definition of a small business.

*D. Compliance, Reporting, and Record-Keeping Requirements of Proposed Rule*

In accordance with Section 14 of the CPSA, 15 U.S.C. 2063, manufacturers would have to issue a General Certificate of Conformity (GCC) for each of their gas furnace or boiler models, certifying that the model complies with the proposed performance requirement. Each GCC must also be based on a test of each product or a reasonable testing program and provided to all distributors or retailers of the product. The manufacturer would have to comply with 16 CFR part 1110 concerning the content of the GCC, retention of the associated records, and any other applicable requirements.

*E. Federal Rules that May Duplicate, Overlap, or Conflict with the Proposed Rule*

No Federal rules duplicate, overlap, or conflict with the proposed rule.

#### *F. Potential Impact on Small Entities*

##### 1. Impact on Small Manufacturers

The preliminary regulatory analysis in Section IX of this preamble discusses costs more fully. Based on that analysis, to achieve compliance with the proposed rule's performance requirements, small domestic manufacturers would incur costs from the increased variable costs of producing furnaces and boilers with CO sensors and shutoff capabilities and testing and certifying such products, as well as the one-time conversion costs of redesigning and modifying factory operations for installing CO sensors.

Installing CO sensors and shutoff capabilities in a gas furnace or boiler is a variable cost that is attached to each unit produced. Staff used a Guidehouse study (Guidehouse 2021) to find that the cost to manufacturers (without any markup included) at an annual production level of 119,572 gas furnace and boiler units yields an average incremental cost of \$66.47 per unit.<sup>19</sup> This is an annual total of \$7.95 million ( $\$66.47 \times 119,572$ ) for each small firm.

Regarding the one-time conversion costs, DOE's findings from its 2015 Rules on Gas Residential Furnaces and Boilers (80 FR 13120 and 80 FR 17222) found an industry cost of \$413.28 million (inflated to 2021 dollars).<sup>20</sup> This would suggest a maximum conversion cost for small firms of \$69.02 million (16.7 percent  $\times$  \$413.28 million) or \$13.80 million per firm among the small five manufacturers.

##### 2. Impact on Small Importers

Staff identified one small importer of products that would be within the scope of the standard. Importers may pass on testing responsibility and GCC creation to the foreign manufacturers and then issue the resulting certificate. Changes in production and certification

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<sup>19</sup> Weighted average between retail price increase from gas furnaces (\$65.22) and boilers (\$81.10) for the first year impact of the rule.

<sup>20</sup> Conversion costs were calculated in 2013 dollars and reported in 2020 dollars adjusted for 2013-2020 inflation using the Consumer Price Index-Urban.

costs incurred by suppliers from the standard could be passed on to the importers, which in turn are likely to be passed onto consumers given the relatively inelastic demand for heating appliances. For this reason, the Commission does not believe that the proposed rule will have a significant impact on small importers.

The Commission seeks public comment on information on importers of gas furnaces and boilers; specifically, how many are imported, how many different models each importer sells, and what technologies those models are currently using (atmospheric venting, condensing, non-condensing, premix power burners, etc.). The Commission also seeks public comment on information regarding to what degree supplying firms tend to pass on increases in production and regulatory costs to importers, and to what extent the ability to pass on these costs is limited by the ease with which importers can switch suppliers or substitute to alternative products, such as electrical furnaces and boilers.

#### *G. Alternatives for Reducing the Adverse Impact on Small Businesses*

The Commission considered four alternatives to the proposed rule: (1) continue to work and advocate for change through the voluntary standards process; (2) rely on the use of residential CO alarms; (3) rely on education and information campaigns; and (4) rely on recalls. The Commission is not adopting these alternatives for the reasons in Section IX of the preamble.

The Commission welcomes public comments on this IRFA. Small businesses that believe they would be affected by the proposed rule are encouraged to submit comments. The comments should be specific and describe the potential impact, magnitude, and alternatives that could reduce the impact of the proposed rule on small businesses.

### **XI. Incorporation by Reference**

The Commission proposes to incorporate by reference: ANSI Z21.47-21, Standard: *Gas-fired central furnaces*; ANSI Z21.13-22, Standard: *Gas-fired low-pressure steam and hot water boilers*; and ANSI Z21.86-16, Standard: *Vented Gas-fired space heating appliances*. The Office of the Federal Register (OFR) has regulations regarding incorporation by reference. 1 CFR part

51. Under these regulations, agencies must discuss, in the preamble to a final rule, ways in which the material the agency incorporates by reference is reasonably available to interested parties, and how interested parties can obtain the material. In addition, the preamble to the final rule must summarize the material. 16 CFR 51.5(b)(3).

In accordance with the OFR regulations, section IV of this preamble summarizes the major provisions of ANSI Z21.47-21, Standard: *Gas-fired central furnaces*; ANSI Z21.13-22, Standard: *Gas-fired low-pressure steam and hot water boilers*; and ANSI Z21.86-16, Standard: *Vented gas-fired space heating appliances* that the Commission incorporates by reference into 16 CFR part 1408. The standard itself is reasonably available to interested parties. Until the final rule takes effect, read-only copies of ANSI Z21.47-21, Standard: *Gas-fired central furnaces*; ANSI Z21.13-22, Standard: *Gas-fired low-pressure steam and hot water boilers*, and ANSI Z21.86-16, Standard: *Vented gas-fired space heating appliances* are available for viewing, at no cost, at <https://community.csagroup.org/login.jspa?referer=%252Fgroups%252Fansi-standards-view-access>. Once the rule takes effect, a read-only copy of the standards will be available for viewing, at no cost, at <https://community.csagroup.org/login.jspa?referer=%252Fgroups%252Fansi-standards-view-access>. Interested parties can also schedule an appointment to inspect a copy of the standard at CPSC's Office of the Secretary, U.S. Consumer Product Safety Commission, 4330 East West Highway, Bethesda, MD 20814, telephone: (301) 504-7479; e-mail: [cpsc-os@cpsc.gov](mailto:cpsc-os@cpsc.gov). Interested parties can purchase a copy of the three ANSI standards from the Canadian Standards Association, 8501 East Pleasant Valley Road Independence, OH 44131-5516: 1-800-463-6727; [www.csagroup.org/store/](http://www.csagroup.org/store/).

## **XII. Environmental Considerations**

Generally, the Commission's regulations are considered to have little or no potential for affecting the human environment, and environmental assessments and impact statements are not usually required. See 16 CFR 1021.5(a). The proposed rule is not expected to have an adverse

impact on the environment and is considered to fall within the “categorical exclusion” for the purposes of the National Environmental Policy Act. 16 CFR 1021.5(c).

### **XIII. Preemption**

Executive Order (EO) 12988, Civil Justice Reform (Feb. 5, 1996), directs agencies to specify the preemptive effect of a rule in the regulation. 61 FR 4729 (Feb. 7, 1996). The proposed regulation for gas furnaces and boilers is being promulgated under authority of the CPSA. 15 U.S.C. 2051-2089. Section 26 of the CPSA provides that:

whenever a consumer product safety standard under this Act is in effect and applies to a risk of injury associated with a consumer product, no State or political subdivision of a State shall have any authority either to establish or to continue in effect any provision of a safety standard or regulation which prescribes any requirements as to the performance, composition, contents, design, finish, construction, packaging or labeling of such product which are designed to deal with the same risk of injury associated with such consumer product, unless such requirements are identical to the requirements of the Federal Standard.

15 U.S.C. 2075(a). Thus, the proposed rule would preempt non-identical state or local requirements for gas furnaces and boilers designed to protect against the same risk of injury, *i.e.*, risk of injury and death associated with CO production and leakage from residential gas furnaces and boilers.

States or political subdivisions of a state may apply for an exemption from preemption regarding a consumer product safety standard, and the Commission may issue a rule granting the exemption if it finds that the state or local standard (1) provides a significantly higher degree of protection from the risk of injury or illness than the CPSA standard, and (2) does not unduly burden interstate commerce. 15 U.S.C. 2075(c).

### **XIV. Effective Date**

The Administrative Procedure Act (APA) generally requires that the effective date of a rule be at least 30 days after publication of a final rule. 5 U.S.C. 553(d). Section 9(g)(1) of the CPSA states that a consumer product safety rule shall specify the date such rule is to take effect, and that the effective date must be at least 30 days after promulgation but cannot exceed 180 days from the date a rule is promulgated, unless the Commission finds, for good cause shown, that a later effective date is in the public interest and publishes its reasons for such finding.

The Commission preliminarily proposes an effective date of 18 months after publication of the final rule in the *Federal Register*. The rule would apply to gas furnaces and boilers manufactured after the effective date. The effective date of the proposed rule is based on staff's assessment that, to comply with the final rule, manufacturers would have to:

- Identify and establish contracts with suppliers of CO sensing or combustion control devices;
- redesign the impacted gas furnaces and boilers to integrate CO sensing or combustion control devices;
- work with gas control and control board manufacturers on redesigning gas controls and control boards to properly incorporate power and output signals from CO sensing or combustion control devices;
- conduct qualification testing and analysis of CO sensing or combustion control devices integrated into impacted appliances;
- retool manufacturing lines to allow for CO sensing or combustion control devices to be assembled into impacted appliances;
- incorporate the CO sensing or combustion control devices into existing quality control procedures;
- retrain assembly line staff on the redesigned gas appliances and retooled manufacturing lines;
- incorporate the CO sensing or combustion control devices into the user,

maintenance, and installation instruction manuals of impacted appliances;

- develop new guidance for distributors and retail outlets for the impacted appliances; and
- test and certify of the new models to voluntary standards required in many jurisdictions to meet building codes.

A shorter effective date would likely result in manufacturers being unable to produce compliant products or produce enough products to meet their typical demand; resulting in a product shortage in the supply chain, consumers being denied their preferred product with a loss of utility and potentially an additional cost; and quality control issues.

We note the proposed 18-month effective date is consistent with the applicable voluntary standards for gas furnaces, boilers, and wall and floor furnaces (*i.e.*, ANSI Z21.13, ANSI Z21.47, and ANSI Z21.86, as well as all other ANSI Z21 standards), which typically allow for an effective date of 18 months after new standards provisions are approved. While the proposed 18-month effective date is a departure from the 180-day default effective date required by section 9(g)(1) of the CPSA, the Commission preliminarily concludes that there is good cause here to set the effective date at 18 months for manufacturers to ensure compliance with the proposed performance requirements of the rule based on the reasons discussed above. A detailed discussion of the justification for the recommended 18 month effective date is available in the Staff NPR Briefing Package. The Commission seeks comments on the effective date with specific information to support any argument that an effective date longer than the 180-day period specified in CPSA section 9(g)(1) is or is not justified by good cause, including for the reasons preliminarily identified above.

## **XV. Paperwork Reduction Act**

This proposed rule contains information collection requirements that are subject to public comment and review by the Office of Management and Budget (OMB) under the Paperwork Reduction Act of 1995 (PRA). 44 U.S.C. 3501–3520. We describe the provisions in this section



of the document with an estimate of the annual reporting burden. Our estimate includes the time for gathering certificate data and creating General Certificates of Conformity (GCC), the keeping and maintaining of records associated with the GCCs, and the disclosure of GCCs to distributors and retailers.

CPSC particularly invites comments on: (1) whether the collection of information is necessary for the proper performance of the CPSC's functions, including whether the information will have practical utility; (2) the accuracy of the CPSC's estimate of the burden of the proposed collection of information, including the validity of the methodology and assumptions used; (3) ways to enhance the quality, utility, and clarity of the information to be collected; (4) ways to reduce the burden of the collection of information on respondents, including the use of automated collection techniques, when appropriate, and other forms of information technology; and (5) estimated burden hours associated with label modification, including any alternative estimates.

Title: *Safety Standard for Gas Furnaces and Boilers*

Description: The proposed rule would require each gas furnace and boiler to comply with performance requirements under which the appliance shuts off or modulates when CO levels reach specified amounts for a certain time duration.

Description of Respondents: Persons who manufacture or import gas furnaces and boilers. Staff estimates the burden of this collection of information as follows in Table 2:

**Table 2. Estimated Annual Reporting Burden**

Burden Type	Number of Respondents	Frequency of Responses	Total Annual Responses	Minutes per Response	Total Burden Hours	Annual Cost
GCC Creation	20	500	10,000	5	833	\$63,525
Recordkeeping	20	500	10,000	1.25	208	\$7,005
Third Party Disclosure	20	500	10,000	15	2,500	\$84,200

Section 14(a)(1) of the CPSA, 15 U.S.C. 2063(a)(1), would require manufacturers to certify that their products conform to the proposed rule and issue a GCC. There are 20 known corporate entities supplying gas furnaces and boilers to the U.S. market. On average, each entity may issue 500 certificates for complying gas furnaces or boilers in the market. Each manufacturer or importer may issue 500 certificates for a total of 10,000 certificates (20 firms times 500 certificates per firm = 10,000 certificates). Staff treats each certificate issued as a new recordkeeping response so there is a total of 10,000 responses for GCC creation. The estimated time required to issue a GCC is estimated at about five minutes (although it often could be less). To comply with the CPSA, gas furnace and boiler manufacturers covered by the rule must subject their products to a reasonable testing program. Quality control and testing is usual and customary for gas furnace and boiler manufacturers, however creation (*i.e.*, recording of test results) may not be. Staff estimates that each firm may spend five minutes per certificate issued recording the results of a reasonable testing program. This would include the time taken to read the test results, create the testing record, and issue a certificate. Therefore, the estimated burden associated with issuance of GCCs is 833 hours (10,000 responses  $\times$  5 minutes per response = 50,000 minutes or 833 hours). Staff estimates the hourly compensation for the time required to issue GCCs is \$76.26 (U.S. Bureau of Labor Statistics, “Employer Costs for Employee Compensation,” March 2023, Table 4, management, business, and financial occupations: <https://www.bls.gov/news.release/pdf/ecec.pdf>). Therefore, the estimated annual cost to industry associated with issuance of a GCC is \$63,525 (\$76.26 per hour  $\times$  833 hours).

We estimate for the purpose of this burden analysis that records supporting GCC creation, including testing records, would be maintained for a five-year period. Staff estimates another 10,000 recordkeeping responses, each one of which requires 1.25 minutes per year in routine recordkeeping. This adds up to 12,500 minutes or 208 hours. Staff estimates the hourly compensation for the time required to issue is \$33.68 (U.S. Bureau of Labor Statistics,

“Employer Costs for Employee Compensation,” March 2023, Table 4, office and administrative support occupations: <https://www.bls.gov/news.release/pdf/ecec.pdf>). Therefore, the estimated annual cost to industry associated with recordkeeping associated with GCCs is \$7,005 (\$33.68 per hour × 208 hours).

Section 14(g)(3) of the CPSA also requires that GCCs be disclosed to third party retailers and distributors. Staff estimates another 10,000 third party disclosure responses, each one of which requires 15 minutes per year. This adds up to 150,000 minutes (10,000 responses x 15 minutes per response) or 2,500 hours. Staff uses an hourly compensation for the time required to disclose certificates to third parties of \$33.68 (U.S. Bureau of Labor Statistics, “Employer Costs for Employee Compensation,” March 2023, Table 4, office and administrative support occupations: <https://www.bls.gov/news.release/pdf/ecec.pdf>). Therefore, the estimated annual cost to industry associated with third party disclosure of GCCs is \$84,200 (\$33.68 per hour × 2,500 hours). There are no operating, maintenance, or capital costs associated with the collection.

Based on this analysis, the proposed standard for gas furnaces and boilers would impose a total paperwork burden to industry of 4,374 hours (833 hours + 833 + 208 hours + 2,500 hours), at an estimated cost of \$154,730 annually (\$63,525 + \$7,005 + \$84,200). Existing gas furnace and boiler manufactures would incur these costs in the first year following the proposed rule’s effective date. In subsequent years, costs could be less, depending on the number of new GCCs issued for gas furnaces and boilers. As required under the PRA (44 U.S.C. 3507(d)), CPSC has submitted the information collection requirements of this proposed rule to the OMB for review. Interested persons are requested to submit comments regarding information collection by **[INSERT DATE 60 DAYS AFTER DATE OF PUBLICATION IN THE FEDERAL REGISTER]**, to the Office of Information and Regulatory Affairs, OMB as described under the **ADDRESSES** section of this notice.

## **XVI. Certification**

Section 14(a)(1) of the CPSA requires that products subject to a consumer product safety rule under the CPSA, or to a similar rule, ban, standard or regulation under any other act enforced by the Commission, must be certified with a GCC as complying with all applicable CPSC-enforced requirements. 15 U.S.C. 2063(a). A final rule would subject gas furnaces and boilers to this requirement.

## **XVII. Promulgation of a Final Rule**

Section 9(d)(1) of the CPSA requires the Commission to promulgate a final consumer product safety rule within 60 days of publishing a proposed rule. Otherwise, the Commission must withdraw the proposed rule if it determines that the rule is not reasonably necessary to eliminate or reduce an unreasonable risk of injury associated with the product or is not in the public interest. However, the Commission can extend the 60-day period, for good cause shown, if it publishes the reasons for doing so in the *Federal Register*. 15 U.S.C. 2058(d)(1).

The Commission finds that there is good cause to extend the 60-day period for this rulemaking. Under both the APA and the CPSA, the Commission must provide an opportunity for interested parties to submit written comments on a proposed rule. 5 U.S.C. 553; 15 U.S.C. 2058(d)(2). The Commission is providing 60 days for interested parties to submit written comments. A shorter comment period may limit the quality and utility of information CPSC receives, particularly for areas where it seeks data and other detailed information that may take time for commenters to compile. Additionally, the CPSA requires the Commission to provide interested parties with an opportunity to make oral presentations of data, views, or arguments. 15 U.S.C. 2058. This may require time for the Commission to arrange a public meeting for this purpose and provide notice to interested parties in advance of that meeting. After receiving written and oral comments, CPSC staff must have time to review and evaluate those comments.

These factors make it impractical for the Commission to issue a final rule within 60 days of this proposed rule. Accordingly, the Commission finds that there is good cause to extend the 60-day period for promulgating the final rule after publication of the proposed rule.

## **XVIII. Request for Comments**

We invite all interested persons to submit comments on all aspects of the proposed rule.

The Commission particularly seeks comment on the following items:

- the CO concentration and associated time thresholds in the proposed performance requirements;
- the proposed fail safe provisions in the performance requirement;
- the efficacy of the proposed fail safe provisions and whether there is a more appropriate approach to address fail safe;
- should the proposed performance requirement include an audible alarm notification requirement that indicates when a gas furnace or boiler exceeds the proposed CO limits or when a CO sensor is no longer working properly;
- effort required to obtain sensors and information on sensors including the lifespan;
- effort required to redesign control systems;
- effort required to test prototypes;
- effort required to bring re-engineered appliances to production;
- costs associated with an effective date six months after publication of the rule;
- costs associated with an effective date 30 days after publication of the rule;
- costs associated with shipping and inventory of gas furnaces and boilers;
- costs associated with manufacturing gas furnaces and boilers, along with a description of the process including the timing and whether any firms have seasonal production;
- under the proposed stockpiling provision should zero-production months be averaged in to maintain a roughly constant level of supply for a seasonally produced product to avoid dramatic stockpiling if the manufacturer converted to constant production;
- effort required to incorporate sensors and/or combustion control systems in production;
- data or information on research and development and modifications to the production

process the proposed rule would impose on manufacturers;

- data or information on price elasticity for gas furnaces or boilers;
- additional manufacturers and importers of gas furnaces and boilers that may meet the Small Business Administration (SBA) definition of a small business;
- information on importers of gas furnaces and gas boilers, specifically:
  - how many are imported;
  - how many different models each importer sells; and
  - what technologies those models are currently using (atmospheric venting, condensing, non-condensing, premix power burners, etc.); and
- information regarding the degree to which supplying firms are able to pass on increases in production and regulatory costs to importers.

## **XIX. Notice of Opportunity for Oral Presentation**

Section 9 of the CPSA requires the Commission to provide interested parties “an opportunity for the oral presentation of data, views, or arguments.” 15 U.S.C. 2058(d)(2). The Commission must keep a transcript of such oral presentations. *Id.* Any person interested in making an oral presentation must contact the Commission, as described under the **DATES** and **ADDRESSES** section of this notice.

## **List of Subjects in 16 CFR Part 1408**

Administrative practice and procedure, Consumer protection, Incorporation by reference, Gas furnaces and boilers.

For the reasons discussed in the preamble, the Commission proposes to amend Title 16 of the Code of Federal Regulations by adding a new part to read as follows:

## **PART 1408—SAFETY STANDARD FOR RESIDENTAL GAS FURNACES AND BOILERS**

Sec.

1408.1 Scope, purpose, and effective date.

1408.2 Definitions.

1408.3 Performance requirements for residential gas furnaces and boilers.

1408.4 Incorporation by reference.

1408.5 Prohibited stockpiling.

## Appendix A – Preliminary Findings Under the Consumer Product Safety Act

**Authority:** 15 U.S.C. 2056, 15 U.S.C 2058, and 5 U.S.C. 553.

### **§ 1408.1 Scope, purpose, and effective date.**

This part establishes performance requirements for residential gas furnaces, boilers, and wall and floor furnaces (gas furnaces and boilers) that are consumer products used to heat dwellings, including but not limited to, single family homes, townhomes, condominiums, and multifamily dwellings, as well as multi-family buildings such as apartments and condominiums. The purpose of these requirements is to reduce the occurrence of carbon monoxide-related deaths, injuries, and exposures associated with gas furnaces and boilers. All residential gas furnaces and boilers manufactured after [DATE 18 MONTHS AFTER PUBLICATION OF THE FINAL RULE IN THE *FEDERAL REGISTER*] must meet the requirements of this part.

### **§ 1408.2 Definitions.**

*Gas Central Furnace* means a gas-burning appliance that heats air by the transfer of heat of combustion through a heat exchanger and supplies heated air through ducts to spaces remote from or adjacent to the appliance location.

*Gas Floor Furnace* means a furnace suspended between the floor joists of the space being heated. A floor furnace provides direct heating of the room in which it is located and to adjacent rooms.

*Gas Steam and Hot Water Boiler* means a gas burning appliance that heats steam at a pressure not exceeding 15 psi (100 kPa), or hot water at a pressure not exceeding 160 psi (1100 kPa) and at a temperature not exceeding 250 °F (121 °C). The heated steam or water is pumped

to spaces remote from or adjacent to the appliance location through piping to radiators, where the heat of combustion is transferred to heat the air around the radiator.

*Gas Wall Furnace* means a gas appliance installed within a wall that provides heated air directly to the room in which it is installed and to adjacent rooms through grilles.

### **§ 1408.3 Performance requirements for residential gas furnaces and boilers.**

(a) *General.* All residential vented gas furnaces, boilers, wall furnaces, and floor furnaces must have a means to either directly or indirectly monitor the concentration of carbon monoxide (CO) produced during the combustion process (*i.e.*, “CO emissions”), and shut down or modulate combustion to reduce average CO concentrations to below the CO levels for the durations of time specified in paragraph (b) of this section. If the average CO emissions reach or exceed the CO limits and time durations specified in paragraph (b), then the gas furnace or boiler must either shut down or modulate combustion to reduce average CO emissions to below 150 ppm. If average CO levels range between 200 and 299 ppm for 50 minutes, then the gas furnace or boiler must either shut down or modulate combustion to reduce average CO emissions to below 150 ppm. If average CO levels range between 300 and 399 ppm for 40 minutes, then the gas furnace or boiler must either shut down or modulate combustion to reduce average CO emissions to below 150 ppm. If average CO levels range between 400 and 499 ppm for 30 minutes, then the gas furnace or boiler must either shut down or modulate combustion to reduce average CO emissions to below 150 ppm. If average CO levels range from 500 ppm or higher for 15 minutes, then the gas furnace or boiler must either shut down or modulate combustion to reduce average CO emissions to below 150 ppm. Indirect monitoring and control of CO emissions can be accomplished by monitoring and controlling other combustion parameter(s) that accurately correlate to the production of CO. Examples of parameters that can serve as a proxy for CO production include carbon dioxide (CO<sub>2</sub>), oxygen (O<sub>2</sub>), the Gas/Air Ratio, and the flame ionization current produced by the burner flame.



(b) *Performance requirements for gas furnaces and boilers.* A gas furnace, boiler, wall furnace, or floor furnace must be equipped with a means to continuously monitor CO emission and must meet the requirements using one of the methods described in either paragraph (b)(1)(i) or paragraph (b)(2)(i) for the multipoint method or paragraph (b)(1)(ii) or (b)(2)(ii) for the single point method of this section when tested using the test method described in paragraph (d) of this section.

(1) Direct means to monitor CO emissions. (i) Multipoint method. A gas furnace, boiler, wall furnace, or floor furnace equipped with a means to directly monitor CO emissions, must either cause shut down of the gas furnace or boiler or cause modulation of the gas furnace or boiler combustion, in response to the following conditions within the gas furnace or boiler:

- (A) average CO concentration is 500 ppm or higher for 15 minutes;
- (B) average CO concentration between 400 ppm and 499 ppm for 30 minutes;
- (C) average CO concentration between 300 ppm and 399 ppm for 40 minutes;
- (D) average CO concentration between 200 ppm and 299 ppm for 50 minutes;
- (E) average CO concentration between 150 and 199 ppm for 60 minutes.

(ii) Single point method. A manufacturer may use the single point method instead of the multipoint method described in paragraph (b)(1)(i) for a gas furnace, boiler, wall furnace, or floor furnace equipped with a means to directly monitor CO emissions; which must either cause shut down of the gas furnace or boiler or cause modulation of the gas furnace or boiler combustion, in response to the following conditions within the gas furnace or boiler:

(A) Average CO concentration of 150 ppm or higher for 15 minutes. Shutdown or modulation of the gas furnace or boiler must begin immediately after any of the conditions described in paragraphs (b)(1) (i) (A) through (E) are reached or the alternative condition described in paragraph (b)(1)(ii)(A) is reached. After modulation begins, the CO concentration within the gas furnace or boiler must be reduced to below 150 ppm within 15 minutes.

(B) [Reserved]

(2) Indirect means to monitor CO emissions. (i) Multipoint method. A gas furnace, boiler, wall furnace, or floor furnace equipped with an indirect means to monitor CO emissions, must either cause shut down of the gas furnace or boiler or cause modulation of combustion of the gas furnace or boiler, each in response to the combustion conditions that correlate to the following conditions within the gas furnace or boiler:

- (A) average CO concentration is 500 ppm or higher for 15 minutes;
- (B) average CO concentration between 400 ppm and 499 ppm for 30 minutes;
- (C) average CO concentration between 300 ppm and 399 ppm for 40 minutes;
- (D) average CO concentration between 200 ppm and 299 ppm for 50 minutes;
- (E) average CO concentration between 150 and 199 ppm for 60 minutes.

(ii) Single Point method. A manufacturer may use the single point method instead of the multipoint method described in paragraph (b)(2)(i) for a gas furnace, boiler, wall furnace, or floor furnace equipped with a means to indirectly monitor CO emissions, which must either cause shut down of the gas furnace or boiler or cause modulation of combustion within the gas furnace or boiler, in response to the following condition within the gas furnace or boiler:

(A) Average CO concentration of 150 ppm or higher for 15 minutes. Shutdown or modulation of the gas furnace or boiler must begin immediately after any of the conditions described in paragraphs (b)(2)(i)(A) through (E) are reached or the alternative condition described in paragraph (b)(2)(ii)(A) is reached. After modulation begins, the CO concentration within the gas furnace or boiler must be reduced to below 150 ppm within 15 minutes.

(B) [Reserved]

(3) Fail Safe. During the life of the gas furnace or boiler, if a CO sensor, combustion sensor, combustion control system, or other device designed to meet these requirements fails to operate properly or at all, then the gas furnace or boiler must shutdown and restart after 15 minutes and repeat this cycle until the failed component is replaced. Consumers and service technicians must

be notified of device failure by either a flashing light or other appropriate code on the gas furnace or boiler control board that corresponds to the device failure.

(c) *Test Configuration.* Gas furnace or boilers must be configured in the following manner for testing. Gas Furnaces, boilers, wall furnaces, and floor furnaces must each be set up with the burner and primary air adjusted in accordance with the provisions of the Combustion sections of the respective voluntary standards (section 5.8.1 of ANSI Z21.47-2021 for gas furnaces; section 5.5.1 of ANSI Z21.13-2022 for gas boilers; and sections 9.3.1, 11.2.1, and 13.3.1, of ANSI Z21.86-2016 for gas wall and floor furnaces). These tests must be conducted in an atmosphere having normal oxygen supply of approximately 20.94 percent. Burner and primary air adjustments must be made for furnaces, boilers, wall furnaces, and floor furnaces in accordance with the provisions of each respective standard (section 5.5.4 of ANSI Z21.47-2021 for gas furnaces; section 5.3.1 of ANSI Z21.13-2022 for gas boilers; and section 2.3.4 of ANSI Z21.86-16 for gas wall and floor furnaces). After adjustment, and with all parts of the furnace, boiler, wall furnace, or floor furnace at room temperature, the pilot(s), if provided, must be placed in operation and allowed to operate for a period of five minutes. The main burner(s) must then be placed in operation and the gas furnace or boiler operated for three minutes at normal inlet test pressure at which time a sample of the flue gases must be secured. Immediately upon securing the sample at normal inlet test pressure, the reduced inlet test pressure (section 5.5.1 of ANSI Z21.47:2021; section 5.3.1 of ANSI Z21.13-2022; and section 2.3.1 of ANSI Z21.86-16) must be applied and, following a purge period of at least two minutes, another sample of the flue gases must be secured. For atmospheric burner units, samples must be secured at a point preceding the inlet to the unit's draft hood or flue outlet where uniform samples can be obtained. The flue gas sample must be analyzed for carbon dioxide and carbon monoxide. The average concentration of carbon monoxide for the flue gas samples must not exceed 150 ppm in a sample of flue gases after 15 minutes.

(d)(1) Test Procedure. To test a furnace, boiler, wall furnace, or floor furnace to the performance requirements specified in paragraph (b) of this section, induce the production of CO or related combustion parameters, one or a combination of the following methods must be used:

(i) Progressively increase the gas control valve's outlet pressure until the unit produces a CO concentration of approximately 150 ppm  $\pm$ 10 ppm CO. For natural gas units, use a propane conversion kit to achieve the desired CO concentration if this was not accomplished by increasing the gas valve's outlet pressure. For propane units, use either option in paragraph (b)(2)(i)(B) or (C). If neither option results in a CO concentration of approximately 150 ppm, then use both options in paragraphs (b)(3)(i) (B) and (C). Once a CO concentration of at least 150 ppm is achieved, that condition must be maintained for 15 minutes.

(ii) Progressively block the exhaust vent or flue outlet until the unit produces approximately 150 ppm  $\pm$ 10 ppm CO. Disable the unit's blocked vent shutoff switch (BVSS) if necessary, in order to achieve the desired CO concentration. Once a CO concentration of approximately 150 ppm is achieved, that condition must be maintained for 15 minutes.

(iii) Reduce the fan speed of the inducer motor or premix power burner (for induced draft or premix power burner units only) by reducing the supply voltage to 85 percent of the gas furnace or boiler rating plate voltage until the unit produces a CO concentration of approximately 150 ppm  $\pm$ 10 ppm CO. An additional combustion sample must be secured with the gas furnace or boiler operating at normal inlet test pressure and with the supply voltage reduced to 85 percent of the gas furnace or boiler rating plate voltage. This sample must be secured 15 minutes after the furnace has operated at the reduced voltage. The input rating may vary from normal as a result of the voltage reduction. Once a CO concentration of approximately 150 ppm is achieved, that condition must be maintained for 15 minutes.

For gas furnaces and boilers that employ modulation (e.g., using a Gas/Air Ratio Controller, an automatic step-rate control, or automatic modulating controls, etc.) the unit must

immediately begin modulation to reduce the CO concentration to below 150 ppm. For gas furnaces and boilers that do not employ modulation, the unit must shut down.

(2) Time for shutoff using multipoint method or modulation. The time for the gas to the main burner(s) to be shut off or begin modulation by the device used to directly or indirectly monitor CO emissions must be:

- (i) After 15 minutes at an average CO concentration of 500 ppm or more.
- (ii) After 30 minutes at an average CO concentration of 400 ppm-499.
- (iii) After 40 minutes at an average CO concentration of 300-399 ppm.
- (iv) After 50 minutes at an average CO concentration of 200-299 ppm.
- (v) After 60 minutes at an average CO concentration of 150-199 ppm.

(3) Time for shutoff using single point method or modulation. A manufacturer, instead of using the multipoint method describe in paragraph (d)(2) may use the following single point conditions and time to shut off the gas furnace or boiler or begin modulation in response to the following condition within the gas furnace or boiler:

- (i) Average CO concentration of 150 ppm or higher for 15 minutes. Shutdown or modulation of the appliance shall begin immediately after any of the conditions described in paragraph (d)(2) is reached. After modulation begins, the CO concentration within the appliance shall be reduced to below 150 ppm within 15 minutes.
- (ii) [Reserved]

#### **§ 1408.4 Incorporation by reference.**

Certain material is incorporated by reference into this part with the approval of the Director of the Federal Register in accordance with 5 U.S.C. 552(a) and 1 CFR part 51. All approved incorporation by reference (IBR) material is available for inspection at the Consumer Product Safety Commission and at the National Archives and Records Administration (NARA). Contact the U.S. Consumer Product Safety Commission at: Office of the Secretary, U.S. Consumer Product Safety Commission, 4330 East-West Highway, Bethesda, MD 20814; telephone (301)

504-7479; e-mail [cpsc-os@cpsc.gov](mailto:cpsc-os@cpsc.gov). For information on the availability of this material at NARA, visit [www.archives.gov/federal-register/CFR/IBR-locations.html](http://www.archives.gov/federal-register/CFR/IBR-locations.html) or email [fr.inspection@nara.gov](mailto:fr.inspection@nara.gov). The following material may be obtained from the Canadian Standards Association, 8501 East Pleasant Valley Road, Independence, OH 44131-5516: 1-800-463-6727; [www.csagroup.org/store/](http://www.csagroup.org/store/):

- (a) ANSI Z21.13-2022, Standard: *Gas-fired low-pressure steam and hot water boilers*, published August 2022.
- (b) ANSI Z21.47-2021, Standard: *Gas-fired central furnaces*, published May 2021.
- (c) ANSI Z21.86-2016, Standard: *Vented gas-fired space heating appliances*, published January 2017.

#### **§ 1408.5 Prohibited stockpiling.**

(a) *Prohibited acts.* Manufacturers and importers of gas furnaces, boilers, wall furnaces, and floor furnaces shall not manufacture or import products that do not comply with the requirements of this part between [DATE OF PUBLICATION OF FINAL RULE] and [EFFECTIVE DATE OF FINAL RULE] at a rate greater than 106 percent of the base period in the first 12 months after promulgation of the rule, and 112.50 percent of the base period for the remaining six months until the effective date for the rule.

(b) *Base period.* The base period for gas furnaces, boilers, wall furnaces, and floor furnaces is the calendar month with the median manufacturing or import volume within the last 13 months immediately preceding the month of promulgation of the final rule.

#### **Appendix A to Part 1408 — Preliminary Findings Under the Consumer Product Safety Act**

The Consumer Product Safety Act requires that the Commission, in order to issue a standard, make the following findings and include them in the rule. 15 U.S.C. 2058(f)(3).

##### *A. Degree and Nature of the Risk of Injury.*

The Commission proposes this rule to reduce the risk of death and injury associated with CO production and leakage from residential gas furnaces, boilers, wall furnaces, and floor

furnaces. Between 2017 to 2019 (the most recent period for which data are complete), there were annually an estimated 21 CO deaths associated with residential gas furnaces and boilers. For the 20-year period 2000 through 2019, these products were associated with a total of 539 CO deaths. Between the years 2014 and 2018, 236 nonfatal injuries were reported through the National Electronic Injury Surveillance System (NEISS) related to CO leakages from gas furnaces and boilers. Staff used NEISS incidents and the Injury Cost Model to extrapolate and generate national estimates for injuries from CO leakages from gas furnaces and boilers with 30,587 nonfatal injuries from CO leakages from 2014 to 2018.

*B. Number of Consumer Products Subject to the Rule.*

An estimated 70 firms manufacture residential gas furnaces and boilers. When accounting for subsidiaries and multiple brands provided by the same company, 20 parent manufacturers have been identified. In 2020, there was an estimated 60.94 million total number of residential gas furnaces and boilers in use. In 2021 residential gas furnace sales were estimated to be 3.58 million units, and 0.30 million units for gas boilers.

*C. Need of the Public for the Products and Probable Effect on Utility, Cost, and Availability of the Product.*

(1) Residential gas furnaces and boilers are fueled by natural gas or propane (gas) and are used to heat all categories of residential dwellings, including single family homes, townhomes, condominiums, and multifamily dwellings, as well as small-to medium-sized commercial dwellings. Because the rule is a performance standard that allows for the sale of compliant gas furnaces and boilers, it is not expected to have an impact on the utility of the product.

(2) The cost of compliance to address CO hazards include increased variable costs of producing furnaces and boilers with CO sensors and shutoff capabilities; one-time conversion costs of redesigning and modifying factory operations for installing CO sensors; increased maintenance costs of gas furnaces and boilers to consumers, and deadweight loss in the market caused by the increasing price due to regulation and the subsequent decline in sales. Staff

performed a 30-year prospective cost assessment (2025-2054) on all four cost categories and estimated the total annualized cost from the proposed rule to be \$602.27 million, discounted at three percent. Staff estimated the per-unit (of a gas furnace or boiler) costs from the proposed rule to be \$158.11, discounted at three percent.

Dead weight loss refers to the lost producer and consumer surplus from reduced quantities of gas furnaces and boilers sold and used due to the rule-induced increases in manufacturer cost and retail price. Producer surplus represents the difference between the amount a producer is willing to sell a good or service for and the price they actually receive. Consumer surplus represents the benefit that consumers receive from purchasing a good or service at a price that is lower than their willingness to pay. For those units no longer produced due to the rule, suppliers lose out on the producer surplus associated with those units, and consumers lose out on the consumer surplus associated with those units.

In the first year, producer manufacturing costs are expected to increase by \$22.08 per gas furnace causing a \$70.44 per unit in higher retail costs to the consumer in the form of higher retail prices. Gas boiler manufacturing costs are expected to increase by \$26.54 per unit causing an \$87.59 in higher retail costs to the consumer. The resultant decrease in the number of gas furnaces and boilers sold and used is expected to generate a dead weight loss of about \$1 million per year nationwide.

(3) Staff does not expect that the availability of gas furnaces and boilers will be substantially impacted by the rule. Staff estimates baseline (status quo) sales of 3.96 million units of gas furnaces and boilers in 2025 which in the absence of the rule, would grow to 4.72 million by 2054. With the promulgation of the rule staff expects gas furnace and boiler sales of 3.92 million units in 2025 would grow to 4.69 million units by 2054.

*D. Any Means to Achieve the Objective of the Rule, While Minimizing Adverse Effects on Competition and Manufacturing.*



(1) The rule reduces CO hazards associated with residential gas furnaces and boilers while minimizing the effect on competition and manufacturing. Manufacturers can transfer some, or all, of the increased production cost to consumers through price increases. At the margins, some producers may exit the market because their increased marginal costs now exceed the increase in market price. Likewise, a very small fraction of consumers may be excluded from the market if the increased market price exceeds their personal price threshold for purchasing a gas furnace or boiler. However, the Commission did not find any information or assessment that would suggest significant changes to market competition or composition.

(2) The Commission considered alternatives to the rule to minimize impacts on competition and manufacturing including: (1) continuing to work and advocate for change through the voluntary standards process; (2) relying on the use of residential CO alarms; (3) continuing to conduct education and information campaigns; and (4) relying on recalls. The Commission determines that none of these alternatives would adequately reduce the risk of deaths and injuries associated with the CO hazards presented by residential gas furnaces and boilers.

*E. The rule (including its effective date) is reasonably necessary to eliminate or reduce an unreasonable risk of injury.* Between 2000 and December 2019, incident data show 539 fatal incidents related to CO hazards associated with gas furnaces and boilers. The incident data show that these incidents continue to occur and are likely to increase because the existing ANSI voluntary standards do not have requirements that would adequately reduce the CO hazard presented by gas furnaces and boilers and the market for gas furnaces and boilers is forecast to grow. The rule establishes performance requirements to address the risk of CO poisoning associated with residential gas furnaces and boilers. The effective date provides a reasonable amount of time for manufacturers to comply with the rule and produce products that prevent the CO hazard. Given the deaths and injuries associated with CO leakage from gas furnaces and

boilers, the Commission finds that the rule and its effective date are necessary to address the unreasonable risk of injury associated with gas furnaces and boilers.

*F. Public Interest.* The rule addresses an unreasonable risk of death and injuries presented from CO hazards associated with gas furnaces and boilers. Adherence to the requirements of the rule would reduce deaths and injuries from CO poisoning associated with gas furnaces and boilers; thus, the rule is in the public interest.

*G. Voluntary Standards.* If a voluntary standard addressing the risk of injury has been adopted and implemented, then the Commission must find that the voluntary standard is not likely to eliminate or adequately reduce the risk of injury or substantial compliance with the voluntary standard is unlikely. The Commission determines that the relevant U.S. voluntary standards (ANSI Z21.13-2022, ANSI Z21.47-2021, and ANSI Z21.86-2016) do not contain performance requirements to protect against the known failure modes or conditions identified that have been associated with the production and leakage of CO into living spaces of U.S. residences resulting in numerous deaths and injuries, and thus do not adequately address the hazard of CO exposure from residential gas furnaces and boilers.

*H. Reasonable Relationship of Benefits to Costs.*

The Commission determines the benefits expected from the rule bear a reasonable relationship to its costs. The rule significantly reduces the CO hazard associated with residential gas furnaces and boilers, and thereby reduces the societal costs of the resulting injuries and deaths. When costs are compared to benefits, the estimated costs of the rule are greater than the estimated benefits. Staff calculates net benefits (benefits less costs) to be -\$245.74 million on annualized basis, discounted at three percent. The net benefits on per-unit basis are -\$64.51, discounted at three percent. Alternatively, this can be described as the proposed rule being a net cost of \$64.51 per gas furnace or boiler, which represents approximately three percent of the average price of a gas furnace or boiler. Overall, the proposed rule has a benefit-cost ratio of 0.59; in other words, for every \$1 in cost of the proposed rule, there is a return of \$0.59 in

benefits from mitigated deaths and injuries. However, the rule is estimated to address 90-100 percent of deaths caused by the CO hazard associated with gas furnaces and boilers, resulting in potential total societal annualized benefits from the rule of \$356.52 million, discounted at three percent. Staff conducted a sensitivity analysis that showed if by 2035 manufacturers were able to develop compliant gas furnaces and boilers with CO sensors that did not need replacement, and if the analysis took into account that a child's death is considered twice as costly as an adult death, the benefit-cost ratio would increase to 0.78.

*I. Least-Burdensome Requirement that Would Adequately Reduce the Risk of Injury.* The Commission considered four alternatives to the proposed rule: (1) continue to work and advocate for change through the voluntary standards process; (2) rely on the use of residential CO alarms; (3) continue to conduct education and information campaigns; and (4) rely on recalls. Although these alternatives may be less burdensome alternatives to the rule, the Commission determines that none of the alternatives would adequately reduce the risk of deaths and injuries associated with gas furnaces and boilers that is addressed by the rule.

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